Electronic Services - Los Angele
M13808X

INSTRUCTION MANUAL

MODEL GFD-2 DISCRIMINATOR

DATA Control Sys.

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SECTION I

INSTALLATION OF GFD-2 DISCRIMINATOR

1. Power:

Power requirements for the GFD-2 Discriminator are 105-125 volts at 55-65 cps. No external regulation is required if line is maintained within these limits.

2. Cooling:

Provisions should be made for chimney cooling of the GFD-2 Discriminator with moving air at an ambient temperature less than 40°C. Stability of the unit and component life will be impaired if excessive cooling air temperatures prevail. When operated on a bench, the unit should be supported on wooden blocks which elevate it above the table top by a few inches to permit convection cooling to take place.

SECTION II

OPERATION OF GFD-2 DISCRIMINATOR

1. Plug Connections:

The plug at the rear of the GFD-2 Discriminator is a Cannon Electric #DPD-32C2-33-1L. The mating connector is a Cannon Electric #DPD-32C2-33S-1L. Before attempting operation of the discriminator, the output connector should be connected as shown in Dwg. DO-005003.

NOTE: For normal simple operation, the following connections MUST be made:

Connect Pin No.	To	Pin No.
6		13
18		10
19		26
22		28
20		24
21		23

The 115 volts, 60 cps power connects to pins No. 1 and 2. Input is low capacity coaxial cable to pin No. A-1. Output is from pins No. 7 or 8 and 9 (ground).

No other connections may be made to the rear connector except as indicated below.

a. The 105-125 volt, 55-65 cps line must be connected to pins 1 and 2.

b. Pins 3, 4, 5, 11 and 12 are used with automatic calibration only and are left open when automatic calibration is not used.

c. Pin Nos. 6 and 13 are in series with the internal input level meter. When using an external level meter, connect the plus side to pin No. 6 and the minus side to pin No. 13. When an external input level meter is not used, short pin No. 6 to pin No. 13. If these pins are not shorted, input level meter will not operate.

d. Pin Nos. 7 and 8 are internally connected and are discriminator output. Appropriate connections may be made at these points to pin No. 9 (ground).

e. Pin No. 9 is output ground. Pins 13, 14, 15, 26, 28, 29 and 30 are also ground, but it is suggested that output ground be taken from pin No. 9. Output ground is also considered "EXT. GAIN 1C."

f. Pin No. 10 is "EXT. GAIN 1A." Pin No. 18 is "EXT. GAIN 1B" and pin No. 9 is "EXT. GAIN 1C." Refer paragraph 5, Section II for details. Pin No. 10 must be connected to pin No. 18 for proper operation if external gain resistors are not used.

g. Pin Nos. 16 and 17 have internal connections and must not be used for any connection under any circumstances.

h. Pin No. 19 is an "External Zero Offset" input. Voltages may be inserted between pin No. 19 and ground (pin No. 26). If no voltage for "External Zero Offset" is desired, pin No. 19 must be connected to Pin No. 26 for proper operation.

i. Pin Nos. 20 and 21 have dummy automatic calibration resistors internally connected. When automatic calibration is not used, pin No. 20 must be connected to pin No. 24 and pin No. 21 must be connected to pin No. 23.

j. Tape speed error compensation (wow and flutter compensation) may be inserted between pin No. 22 and ground (pin No. 28). If wow and flutter compensation is not used, pin No. 22 must be connected to pin No. 28 for proper operation.

k. Pin Nos. 23, 24 and 25 are "External Gain 11" and are used to adjust gain in automatic calibration operation. If automatic calibration is not used, pins must be connected as indicated in paragraph 1-i above. Pin No. 25 remains open.

1. Pin No. 27 is a subcarrier monitor which is connected to one-eleventh of the sub-carrier at the output of the band pass input filter. This monitors the channel subcarrier filtered from the multiplex.

2. Channel Selection:

A plug-in unit for the channel to be used should be selected and a low pass filter unit of appropriate cut-off frequency installed. (This unit is inserted from rear of channel selector with channel tag oriented so that the numbers are erect when viewed from front of unit; unit snaps into place when pushed all the way in.) The IRIG nominal intelligence for the channel used is suggested as the low pass filter cut-off frequency, but others may be used. After installing the low pass filter, the entire channel selector is plugged into the front of the discriminator and the quarter-turn fasteners on each side are locked. To remove, unlock quarter-turn fasteners and pull entire plug-in unit from discriminator. To remove low pass unit from channel selector, press spring tab on top back of low pass unit upward to release, and can will slide out.

3. Power:

Power is applied to the unit by depressing the push button switch pilot light marked "Power" on the front panel. After a five-minute warm-up, adjustment of the unit can begin. Drift specifications require a 60 minute warm-up before .5% full bandwidth long term stability can be assumed.

4. Band Center Adjustment:

Band center adjustment is made by applying to the input terminals a band center frequency carrier with an amplitude between 10 millivolts and 10 volts. With levels in this range, the input level meter at the left of the front panel should read in the green region of its scale. The screwdriver adjustment located to the right of the channel selector handle is used to adjust the output meter to center scale. (This is a ten-turn potentiometer.)

5. Output Level:

Output level control on the right side of the unit may be adjusted to obtain the desired output level. On the position marked "Internal", the nominal full scale

deviation will produce an output of ±10 volts which is independent of the setting of the concentric potentiometer. On other positions, the full scale output voltage ranges between the numbers at either side of the switch index; adjustment between these limits is made with the continuous control which is concentric with the level switch. On the position marked "External", the full scale deviation depends upon a pair of resistors connected to pins 18, 9 and 10 at the rear of the discriminator. Selection of a pair of resistors permits any desired fixed sensitivity within the normal capabilities of the unit to be selected. Output of the discriminator is accessible from the front by means of the monitor jack located to the left of the output.

6. Limiter Switch:

Limiter switch on the front panel may be depressed to turn on the limiter positive feedback. If this control is "ON", the discriminator will return to an output near band center if input signal is lost. If this feature is not used, an output of -150% deviation occurs with loss of signal. For signals above 10 millivolts, the output is independent of the position of this switch.

SECTION III

THEORY OF OPERATION

1. General:

The GFD-2 Subcarrier Discriminator is a self-contained unit which permits recovery of a specific FM data channel multiplexed with other channels. A block diagram of the discriminator is shown in Fig. 1. This unit makes use of the pulse averaging principle for FM detection and includes band pass filter for channel selection, limiter discriminator, analog type output filter, and power supply.

2. Band Pass Filter:

The schematic of the band pass filter of the GFD-2 is shown in Fig. 2. This portion of the circuit serves to separate the desired subcarrier from the other multiplexed channels. The filter is made up of five stages of stagger tuned amplifiers in which the frequencies and Q's of the resonant circuits are chosen to yield the desired filter characteristic. (See figure entitled "Typical Frequency Response Characteristics, Tuning Unit GFD-2/TU".) Each amplifier stage has a large value of resistance in its cathode circuit so that each plate presents a high impedance to its L-C load; this arrangement minimizes the effect of tube tolerances on filter characteristics. The filter output is a cathode follower stage. The L-C-R parallel combinations which make up each plate load are located physically in the tuning unit, Model GFD-2/TU, which plugs into the discriminator front panel. Provisions are made in the discriminator for feeding back from the output of the limiter to the fifth tuned stage so that loss of signal will permit the linear-tuned amplifier combination to oscillate near the center frequency of the channel until a signal is restored.

The center frequency gain of the entire filter varies between 0.6 and about 1.2 as a function of channel frequency.

3. Limiter:

A schematic of the limiter in the GFD-2 is shown in Fig. 3. This circuit in combination with the Schmidt Trigger of Fig. 4 serves to generate a pulse which coincides in time with the zero-axis crossing of the subcarrier signal.

The limiter consists of two sections which are identical in principle. Each section consists of a pentode amplifier and a cathode follower output stage. Two diodes in the output stage provide feedback which reduces the amplifier gain when the output exceeds the bias applied to the diodes. For signals too small to exceed the diode's bias, D.C. feedback establishes an operating point midway between the two diode potentials. This arrangement prevents overloading of amplifier stages for signal levels considerably greater than the linear capabilities of the amplifier stage.

Two sections of limiter are provided to accommodate a dynamic input range in excess of 1000:1. The first section limits at 3 volts peak-to-peak, the second section at approximately 25 volts peak-to-peak. The gain of the two sections for levels below the threshold for the second limiter is approximately 1800 - 3000 with frequency response down 3 db above 100 kc.

4. Schmidt Trigger:

The Schmidt Trigger is shown in Fig. 4. This circuit serves to produce a square wave whose rise time is independent of the frequency or amplitude of the input. This waveform may be differentiated to drive the discriminator circuit with a pulse of well defined characteristics.

5. Discriminator Circuit:

The discriminator circuit proper is shown in Fig 5 in a somewhat simplified form. The function of this circuit is to generate a pulse of constant duration beginning with each positive pulse output of the Schmidt Trigger.

Tubes V-401B and V-402 form a monostable multivibrator whose pulse duration is longer than a cycle of the lowest operating frequency so that this circuit normally operates as a bistable multivibrator. This circuit is monostable to prevent malfunction of the circuit during warm-up or through momentary loss of power.

Tube V-401A is a trigger tube which is normally biased to cut-off. A positive pulse from the Schmidt Trigger turns V-401A "ON" and V-402 "OFF". The positive excursion of the plate of V-402 is applied to the

grid of V-501 and in turn to a grid of V-503. The cathodes of V-503 swing positive cutting off the second section of V-503. The plate current of V-503 is applied normally to the R-C junction of the timing network. This junction is held at ground by diode CR-603 until the second section of V-503 is cut-off. After this, the R-C junction rises in potential exponentially until a Schmidt Trigger, V-601A, B, fires at a grid voltage of about +100 volts. The balance control functions by changing the firing voltage. The output of this trigger is differentiated to trigger the bistable multivibrator back to its original state by driving the trigger tube V-403 to conduction. The multivibrator in turn, turns on the second section of V-503 to return the timing wave to ground to await the next Schmidt Trigger output pulse. The timing capacitor and diode are located in the turning unit at some distance from the discriminator circuit. V-502 is used as a cathode follower to drive the shield on the timing capacitor cable to minimize its capacity. The output of this circuit is a pulse of controlled widths taken from the cathode of V-501.

6. Current Switch:

The constant duration pulse output of the discriminator is applied to the grid of V-701A of the current switch shown in Fig. 6. During this pulse, the grid of V-701A is driven positive which causes the cathodes of V-701 to follow cutting off the current in V-701B whose grid is operated at a fixed voltage. The current in tube V-701B is thus either "ON" or "OFF". When conducting, the current which flows has a very well defined amplitude because the 200 volt drop across the cathode resistor must match the grid bias. The plate of V-701B is connected to the junction of a pair of precision resistors; this junction is at +25 volts when the tube is not conducting at at -25 volts when conducting. Changes in the input frequency produce a change in the duty cycle of this wave since the positive portion of the wave has a fixed duration.

Tape speed compensation is introduced in this circuit by changing the bias on the current tube and by superimposing some of the compensation voltage on the output. This compensation is applied through a filter whose delay matches the band pass filter delay for the channel.

7. Analog Output Filter:

The analog output filter is shown in Fig. 7. Its purpose is to smooth or average the current pulses introduced at its input. In addition, the output filter section provides power, attenuates the output voltage, gives proper deviation sensitivity gain, and compensates for changes in the output of the current switch due to changes that may occur in the B+ and B- voltages.

The analog output filter consists of R-C networks around feedback amplifiers No. 1 and No. 2. These amplifiers are high gain D.C. amplifiers having sufficient gain and bandwidth to reduce to a minimum the error voltages appearing at the input nodes. This arrangement permits the synthesis of filter sections similar to those obtained with L-C networks. The resistors and capacitors comprising the actual filter are as follows:

R-2801	R-2802	R-2803	R-2804
R-2901	R-2902	R-2903	R-2904
C-2801	C-2802	C-2803	C-2901
C-2902	C-2903		

By properly choosing these elements one can obtain various desired characteristics of the low pass filter.

8. Deviation Sensitivity:

The function of the deviation sensitivity resistors is to provide for constant voltage at band edge at the output of the first amplifier regardless of the percentage deviation used. All the elements in the low pass filter are inter-related in that changes in one section affect those in another. This is true of the deviation sensitivity network which not only consists of resistors R-1801 and R-1802, but is also dependent for its action on the resistors of the filter network. The output voltage at D. C., of amplifier No. 1 is determined by the ratio of the feedback resistor R-2804 to the sum of the input resistors R-2801 and R-2802 divided by the fraction of the voltage divider R-1801 and R-1802. These resistors are determined so that the output of amplifier No. 1 at high and low band edge is +10 volts and -10 volts respectively.

9. B+ and B- Compensation:

Small variations in the power supply voltages can cause small variations to appear in the output of the current switch. These variations are virtually cancelled by taking advantage of the characteristics offered by the first amplifier. First of all it has a sign reversal, secondly, it is chopper stabilized making its output virtually independent of power supply voltage changes, and further, its "chopper" drift stabilizing amplifier provides for extremely high gain at D. C. which ensures good accuracy in changing sign at low frequencies. A variation of the power supply voltage causes a variation of the output of the current switch which is translated into a voltage change at the output of the first amplifier. This change is out of phase with that in the power supply. An in-phase component of this voltage change appears across resistors R-955 and R-956 which are so weighted as to completely cancel the out-of-voltage variation leaving a net change of zero volts to appear at the input of the second amplifier. The weighting resistors affect the Q of the second filter section and consequently the source impedance is adjusted to remain constant. It is necessary to change the weighting of the compensation. networks, since changes in the deviation sensitivity cause the power supply variations to appear in different strengths. For a deviation of ±7.5%, a +0.1 volt change out of the +200 volt regulator causes a -.067 volt change to appear at the output of the first amplifier.

10. Output Limiters:

Output limiters are provided to prevent excessive overloading of any equipment tied to the output amplifier. This limiting action is accomplished in two successive stages. The first being the feedback limiter around the first amplifier. This limiter limits the output of the first amplifier to approximately ±16 volts. Consequently no more than this voltage can be put into the second amplifier. The second limiter limits the output voltage to 1.5 times the voltage appearing at any attenuation setting. It should be noted that this limiting action is not a fixed fraction of the output voltage. The mixing network R-968 and R-970 which drives the output limiter is designed to have 4.2 volts appearing at its output at either band edge. Consequently in going beyond band edge, the voltage at this point increases beyond 4.2 volts and limiting action takes place.

11. Output Attenuator:

The purpose of the output attenuator is to change the voltage level appearing at the output of the second amplifier. It does this by changing the external gain of the amplifier, or more specifically, by controlling the amount of output voltage which is fed back. Provision has been made for varying the gain an additional ±10% at any setting in order to accommodate the automatic standardization unit. This is the reason for the second attenuator marked "B" which is in parallel with the main attenuator marked "A". When automatic standardization is not employed, a pair of fixed resistors is used in place of the potentiometer.

SECTION IV

MAINTENANCE

The Model GFD-2 FM/FM Subcarrier Discriminator should require a minimum of maintenance if installed and operated as recommended. However, if maintenance is required, the following information can serve as a guide.

1. Accessibility:

   a. The power supply is of a plug-in design and can be easily removed from the discriminator by removing the seven mounting screws. The circuitry of the power-supply is easily reached for trouble-shooting after the three covers are removed.

   b. All essential areas in the GFD-2 are made accessible by removing the appropriate covers. All covers are attached to the unit with 1/4 turn fasteners. Removal of the top cover will expose the components on the front panel and on the "top tube rack" which is mounted on a hinge and can be lifted after the 1/4 turn fastener in the forward right hand corner is unlocked. It can be held in an upright position by the bracket. Removal of the underside cover of the "top tube rack" will expose additional components.

      If required, the bottom cover on the discriminator can be removed to gain greater accessibility to the "bottom tube rack".

      With all the covers removed, all the essential circuitry is exposed for trouble-shooting. This can be done in most instances without removing the unit from its equipment rack.

2. Inspection Schedule:

a. Weekly Inspection: A weekly visual inspection of the discriminator should be made to check for:

(1) Chimney obstructions
(2) Evidence of overheated components
(3) Defective wiring
(4) Loose components

b. Semi-Annual Inspection: Every six months a complete inspection should be undertaken to:

(1) Check all hardware
(2) Check wiring for defective insulation and connections
(3) Check printed circuit boards for defective connections and overheating
(4) Test all tubes and the chopper
(5) Check circuit voltages at test points (see Voltage Test Charts)
(6) Check waveforms (See Schematic)
(7) Verify operation of unit as indicated under "Performance Check".

3. Test Equipment:

The following test equipment is required to maintain, test and repair the GFD-2 Discriminator.

a. Screwdriver
b. Pliers
c. Soldering iron
d. Ohmmeter
e. V.T.V.M.
f. Oscillator (to 100 kc)
g. Electronic counter

4. Performance Checks:

The following checks are intended to aid in determining if the GFD-2 Discriminator is operating properly. References are made to Schematics CW-005008 and RW-005001.

a. Power Supply: The power supply voltages should be checked. The B+ voltage of +200 volts d-c can be measured from any red wire to ground. The B-voltage of -300 volts d-c can be measured from any white with black tracer wire to ground. Setting the B- voltage to -300 volts d-c should automatically set the B+ voltage at +200 volts d-c. These voltages should be maintained for accurate and precise data handling. The B- voltage can be easily adjusted using potentiometer R124. The a-c ripple voltage on either supply should not exceed 4 mv rms. If the ripple voltage exceeds this value, V101, V103 or V105 should be changed.

b. Band Pass Filter: The passive elements of the band pass filter are located in the GFD-2/TUU and GFD-2/TU Tuning Units. With an oscillator set to within 1% of the band center frequency of the GFD-2/TU and the level set at 10 volts rms, the center frequency gain of the entire band pass filter section varies between 0.6 and 1.2 as a function of band frequency. The gain can be measured at pin 3 of V203B directly or at the "INPUT" monitor jack on the front panel (multiply reading by 11). The "INPUT" level meter should be in the upper end of the green section.

NOTE: The GFD-2/TUU and GFD-2/TU are factory adjusted for constancy of time delay and the cover sealed. If maintenance is required, they must be returned to D.C.S. where the special equipment required to perform adjustments is available.

c. Limiter Sensitivity: The limiter has a threshold of 10 mv rms. No change in the output of the discriminator should be evident if the input level is maintained at or above this level. Below this level the limiting action ceases.

With no signal applied to the discriminator, the "LIMITER" switch should be activated. This will complete the feedback from the output of the limiter to the fifth tuned stage. A loss of signal at the input will permit the limiter tuned amplifier combination to oscillate approximately at the center frequency of the band until the signal is restored.

If the "LIMITER" switch is not activated and the input signal is lost, the "OUTPUT" meter will indicate low band edge and the output voltage will be approximately 140% of band edge value.

d. Output Amplitude: When a standard GFD-2/TU or GFD-2/TUU Tuning Unit is used with a GFD-2/TU/L Low Pass Filter, the output for a ±7.5%, or ±15% frequency deviation should be ±10 volts at band edge when switch SW901 is in position #1. The voltage can be measured at the "OUTPUT" monitor jack. The voltage ranges indicated on the front panel should be obtained approximately for each SW901 position and rotation of R938. Each range should overlap.

Output variations from unit to unit for full deviation for a given position are caused largely by the value of positive and negative supply voltages. This voltage is adjusted by R124 in the power supply.

e. Low Pass Output Filter Amplifier: The output amplifier consists of two major sections; namely, "1st D.C. Amplifier" and "2nd D. C. Amplifier". Localizing the trouble in the output amplifier can be quickly done by shorting the plate of V701B (pin 6) to ground. The d-c voltage measured at the output of the "1st D.C. Amplifier" (pin 8 of V803B) should be zero. If a voltage reading of more than 1% of band edge volts is observed, trouble is localized in this first section.

Similarly, the d-c voltage measured at the output of the "2nd D.C. Amplifier" (pin 1 of V905 or "OUTPUT" monitor jack) should be zero provided the output voltage from the "1st D.C. Amplifier" is zero. If a reading of more than 1% of band edge volts is observed, trouble is localized in the second section. Refer to Schematic RW-005001.

5. Repairs:

Repairs on the GFD-2 Discriminator can easily be made after the trouble has been located. In most cases a tube replacement will correct the abnormal behavior. Components can be removed from the printed circuit boards and replaced but caution should be exercised when doing so. Accepted techniques should be employed using a good soldering iron and an effective heat sink. Excessive heat on the printed circuit boards should be avoided.

All replacements should be made with components that meet the specifications of the original; for example, a 12AX7 tube is not an exact replacement for a ECC83/12AX7. The GFD-2/S Power Supply can be replaced as a complete unit.

6. Charts:

For ease in locating abnormal operation of the GFD-2 Discriminator, reference should be made to the accompanying voltage charts and schematics. Voltage Chart #1 lists typical d-c voltages from tube pins to ground. Voltage Chart #2 lists typical peak-to-peak waveform amplitudes from tube pins. Voltage Chart #3 lists typical d-c voltages in the GFD-2/S Power Supply from tube pins to ground.

Schematic RW-005001 for the GFD-2 shows typical waveforms and voltages appearing at the recommended test points. Schematic CW-005003 for the GFD-2/S Power Supply indicates voltages that must be attained for optimum performance.

Trouble shooting of the discriminator and power supply can be systematically performed by a combination of voltage readings and waveform observation.

7. Spare Parts:

DCS offers two spare parts kits for maintaining the GFD-2 Discriminator:

a. Spare Parts "Kit A" contains the necessary tubes to service one discriminator.

b. Spare Parts "Kit B" contains the necessary components for field maintenance of ten discriminators.

These spare parts lists and kits are available upon request.

VOLTAGE CHART NO. 1

Typical D.C. Voltages from tube pins to ground

MODEL GFD-2 DISCRIMINATOR

Voltages with * measured with 1.0 volt RMS input at 3.0 Kc discriminator at center
Voltages without * measured with zero input
All measurements made with 11 megohm meter impedance
115 volt line

Tube	Pin Number								
	1	2	3	4	5	6	7	8	9
V201	*+170	+ 17	+ 22	---	---	+170	+ 21	+ 26	---
	+170	+ 17	+ 22			+170	+ 26	+ 26	---
V202	*+170	+ 38	+ 43	---	---	+170	+ 38	+ 43	---
	+170	+ 37	+ 40			+170	+ 38	+ 40	
V203	*+170	+ 50	+ 55	---	---	+170	+ 13	+ 16	---
	+170	+ 50	+ 55			+170	+ 13	+ 16	
V301	*- 1.2	0	---	---	+110	+ 73	0	---	---
	- 1.2	0			+110	+ 73	0		
V302	*+200	- 1.5	+ 62	---	---	+105	0	+ 0.3	- 5.0
	+200	- 1.5	+ 68			+105	0	+ 0.3	- 5.0
V303	*+200	N.C.	---	---	N.C.	+ 7.2	+ 10	---	---
	+200					+ 9.0	+ 11.8		
V304	*+ 90	+ 1.4	+ 8.0	---	---	+138	- 3.8	+ 8.2	---
	+ 28	+ 4.7	+ 4.6			+200	- 14.8	+ 4.6	
V401	*+120	- 17	+200	---	---	+120	0	0	- 9.2
	+170	- 17	+200			+170			- 6.4
V402	*- 4	0	---	---	+109	+122	0	---	---
	- 0.2				+ 24	+122			
V403	*- 5	0	---	---	+190	+195	0	---	---
	- 5				+190	+195			
V501	*+190	N.C.	---	---	N.C.	-109	-109	---	---
	+190					-142	-142		
V502	*+ 30	+200	---	---	+200	+200	+ 32	---	---
	- 1.5	+200			+200	+200	+ 2.7		
V503	*- 65	-170	-160	---	---	+ 30	-170	-160	---
	0	-200	-160			- 1.5	-170	-160	
V601	*+170	+ 30	+ 98	---	---	+160	+ 98	+ 98	---
	+170	- 1.5	+ 98			+160	+ 98	+ 98	
V701	* 0	-110	- 85	---	---	0	- 95	- 85	---
		-145	- 95				- 95	- 85	
V801	*+134	- 0.8	0	---	---	+135	- 0.8	0	---
V802	*+200	- 0.3	+ 0.3	---	---	+117	- 0.3	+ 0.3	
V803	*+200	- 1.0	+ 46	---	---	+ 65	+ 0.3	- 0.5	- 3.5
V901	*+125	- 0.5	0	---	---	+125	- 0.75	0	---
V902	*+200	---	+ 0.8	---	---	+120	---	+ 0.8	---
V903	*+200	+ 2.8	+ 60	---	---	+ 73	+ 4.5	+ 4.5	---
V904	*-240	-240	- 39	---	---	- 7.5	-230	N.C.	N.C.
V905	* 0	- 7.5	+242	---	---	+242	0	N.C.	N.C.

VOLTAGE CHART NO. 2

Typical peak-to-peak waveform amplitude

MODEL GFD-2 DISCRIMINATOR

All measurements made with oscilloscope with 10 megohm shunted by 14μμf probe impedance

1 volt RMS input at 3.0 Kc., Discriminator centered
115 volt line

Tube	Pin Number								
	1	2	3	4	5	6	7	8	9
V201	3.5	2.0	2.0	---	---	2.0	3.0	3.0	---
V202	1.25	2.75	2.75	---	---	2.75	3.5	3.25	---
V203	---	2.5	2.5	---	---	2.5	1.25	1.0	---
V301	175mv	---	---	---	8.0	200mv	---	---	---
V302	150mv	750mv	1.0	---	---	45	0	5.0	6.0
V303	---	0	---	---	0	37	38	0	0
V304	140	10	8	---	---	110	35	4.4	---
V401	150	34	---	---	---	150	0	0	17
V402	15	0	---	---	144	4.4	0	---	---
V403	7	0	---	---	150	---	0	---	---
V501	2	N.C.	---	---	N.C.	60	100	---	---
V502	100	.7	---	---	.7	.7	90		
V503	15	120	50	---	---	92	400mv	50	---
V601	46	90	19	---	---	23	21	19	
V701	---	100	38	---	---	30	1.6	38	---
V801									
V802									
V803									
V901									
V902									
V903									
V904									
V905									

VOLTAGE CHART NO. 3

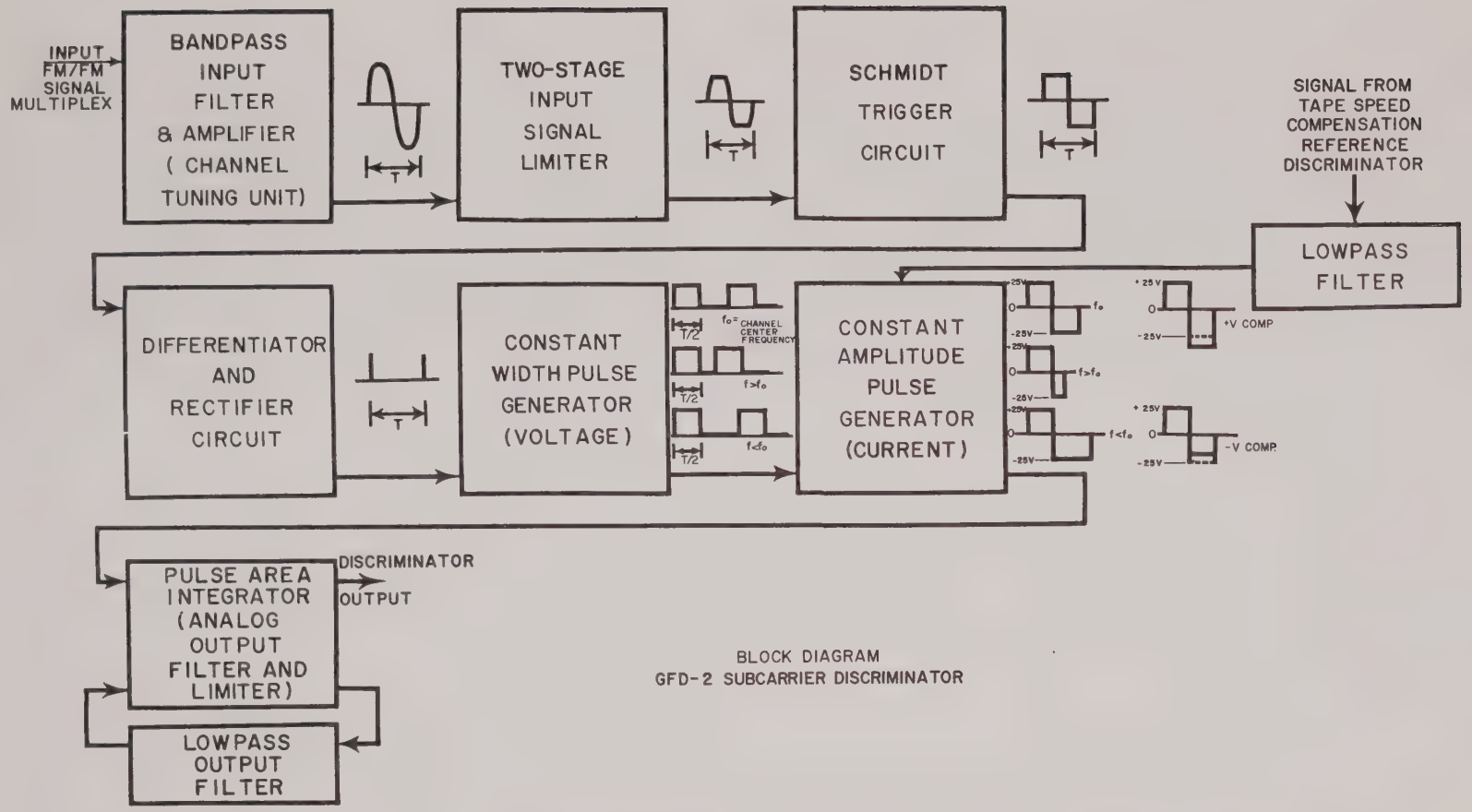
Typical D.C. Voltages from tube pins to ground

GFD-2/PS POWER SUPPLY

All measurements made with 11 megohm meter impedance
115 volt line

Tube	Pin Number								
	1	2	3	4	5	6	7	8	9
V101	+180	+265	+195	- 20	+ 74	0	---	---	---
V102	+180	+ 80	+ 85	---	---	+195	+ 84	+ 85	---
V103	+195	0	+ 0.88	---	---	+111.5	+ 0.28	+ 0.88	---
V104	0	-115	-112	-195	-195	- 21.0	-114	-112	-195
V105	-115	-210	-210	-195	-195	- 0	-210	-210	-195
V106	-210	---	---	---	-210	---	-300	---	---

MODEL GFD-2
SUBCARRIER DISCRIMINATOR



BLOCK DIAGRAM
GFD-2 SUBCARRIER DISCRIMINATOR

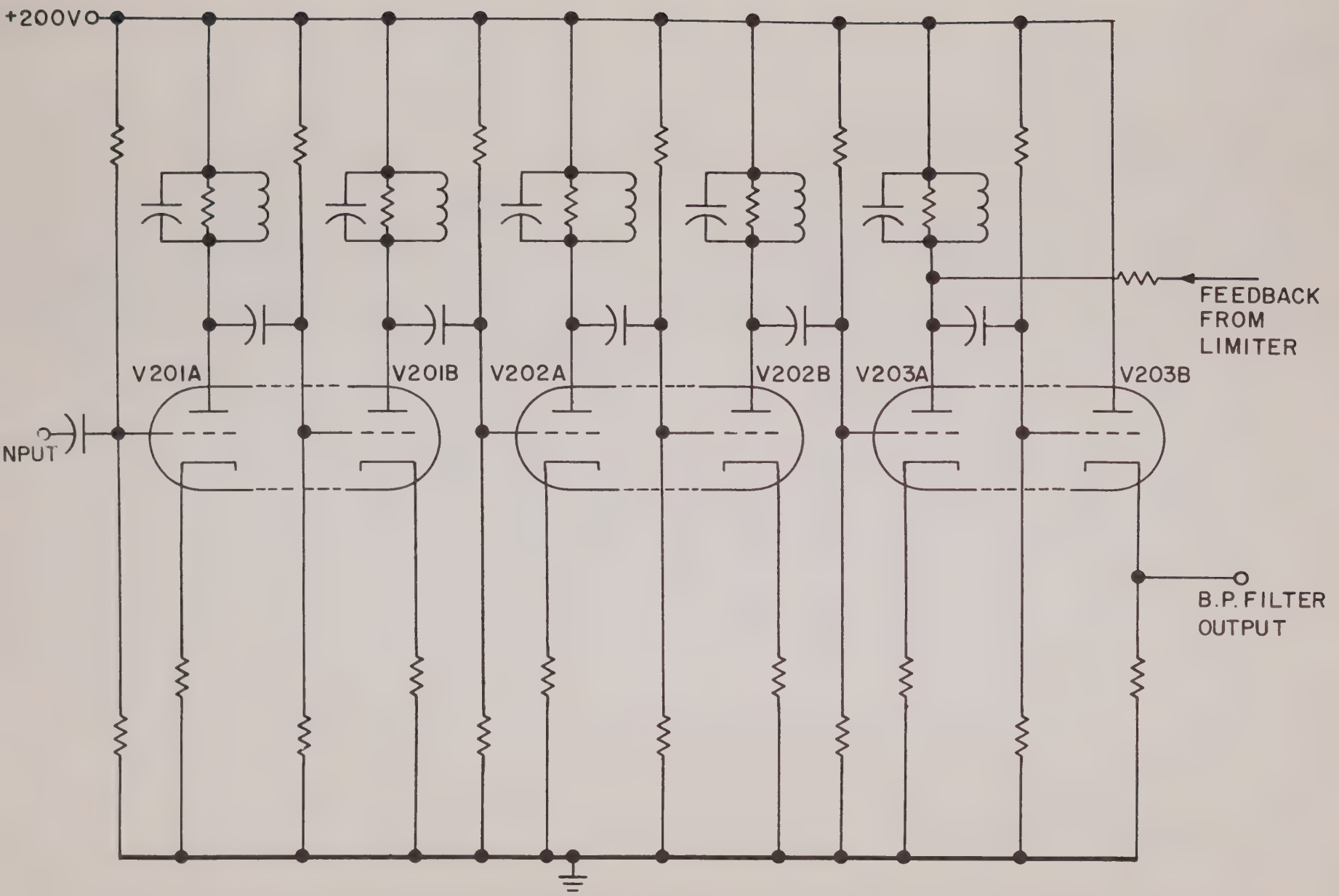


FIG 2 SCHEMATIC BAND PASS FILTER G.E.D. 2 DISCRIMINATOR

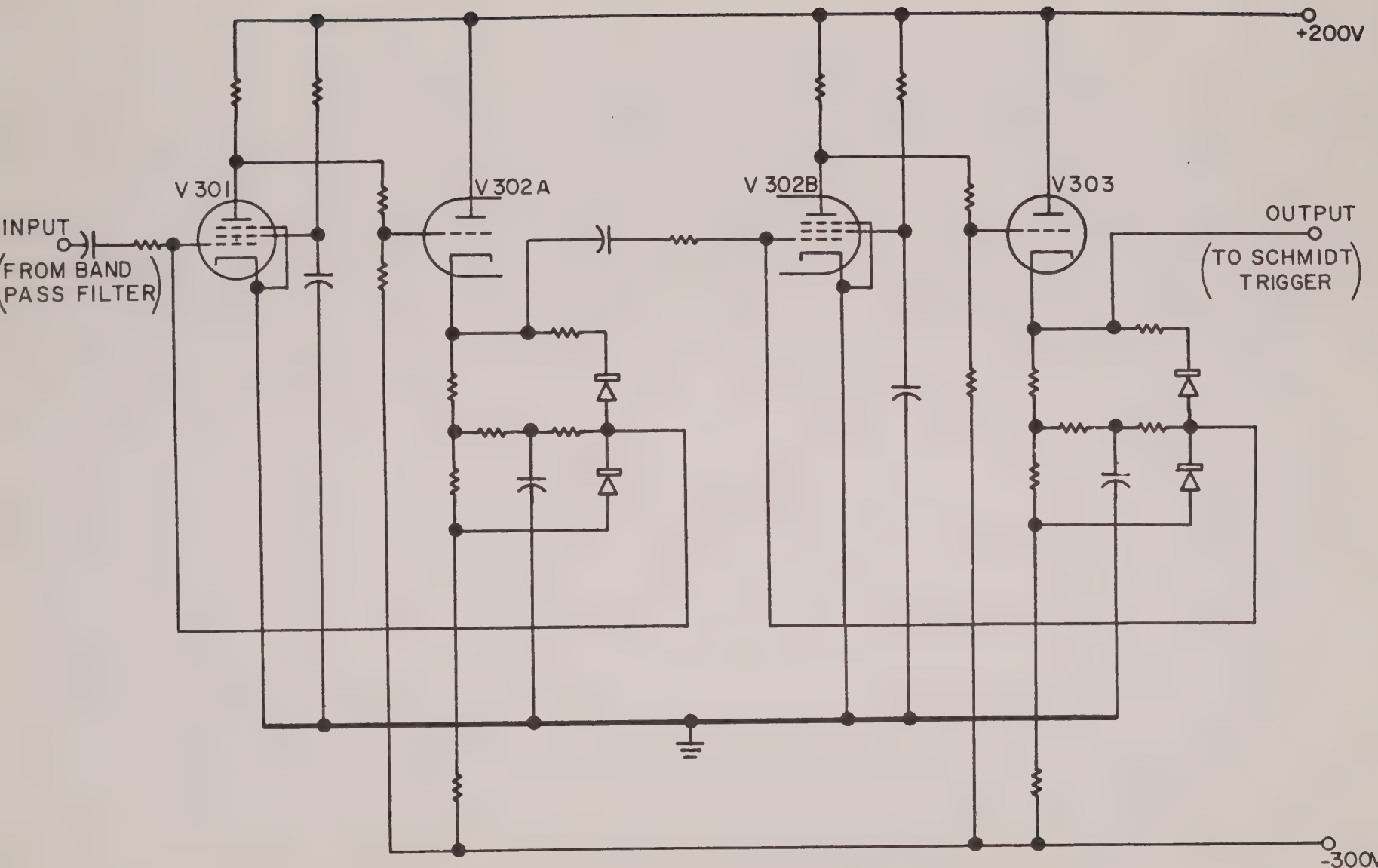


FIG. 3 SCHEMATIC, TWO STAGE LIMITER

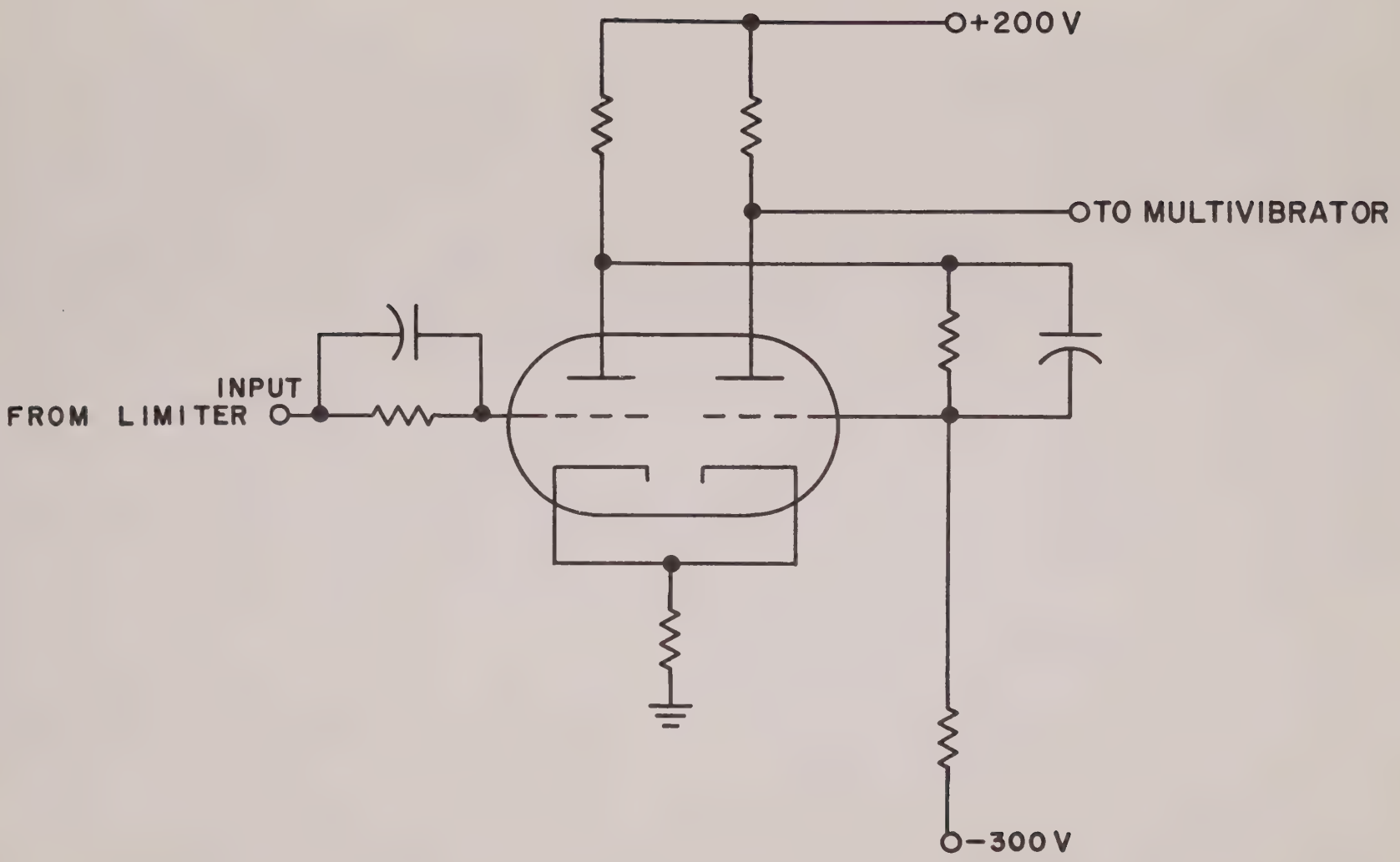


FIG. 4 SCHMIDT TRIGGER

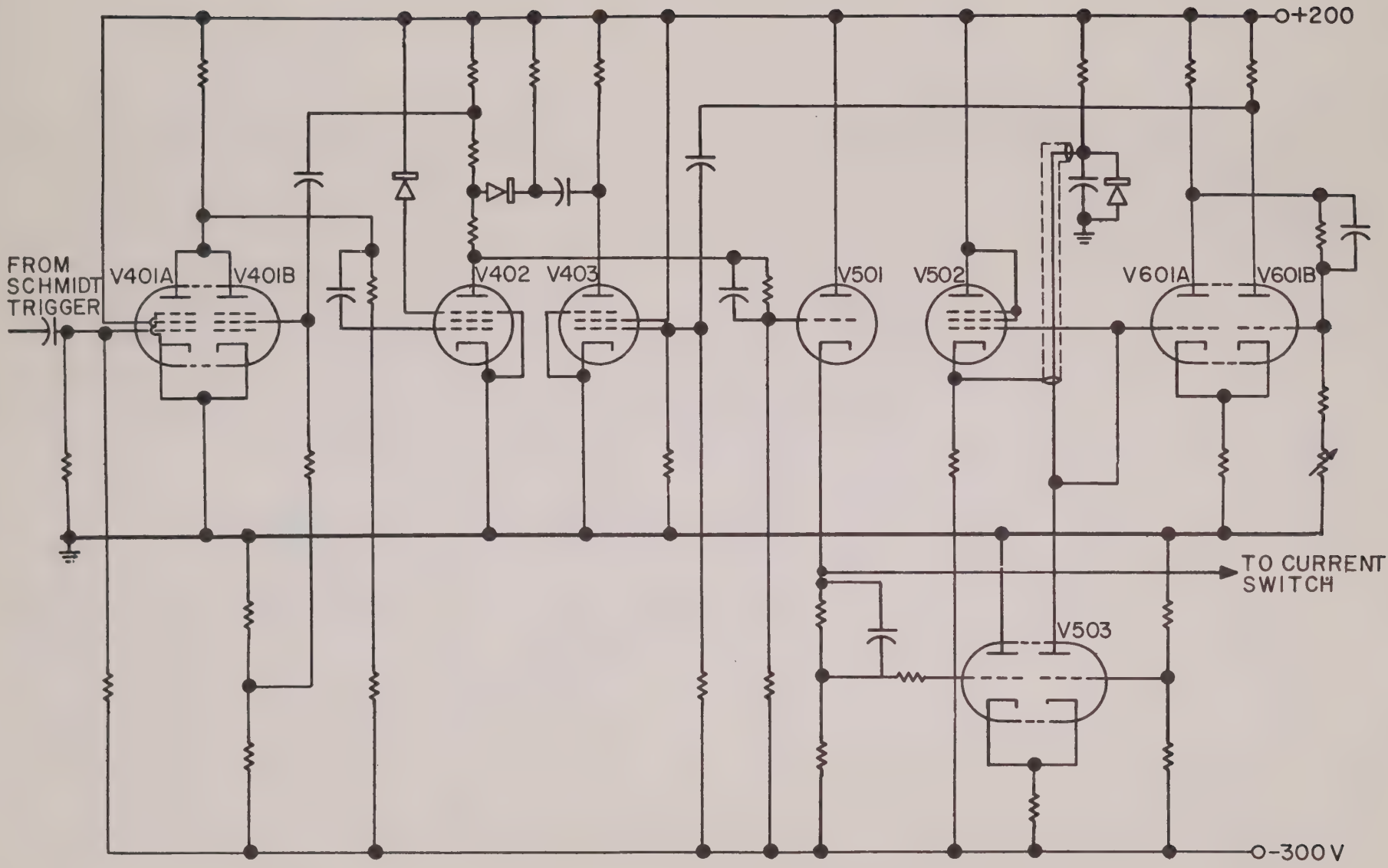


FIG. 5 SIMPLIFIED SCHEMATIC, DISCRIMINATOR CKT.

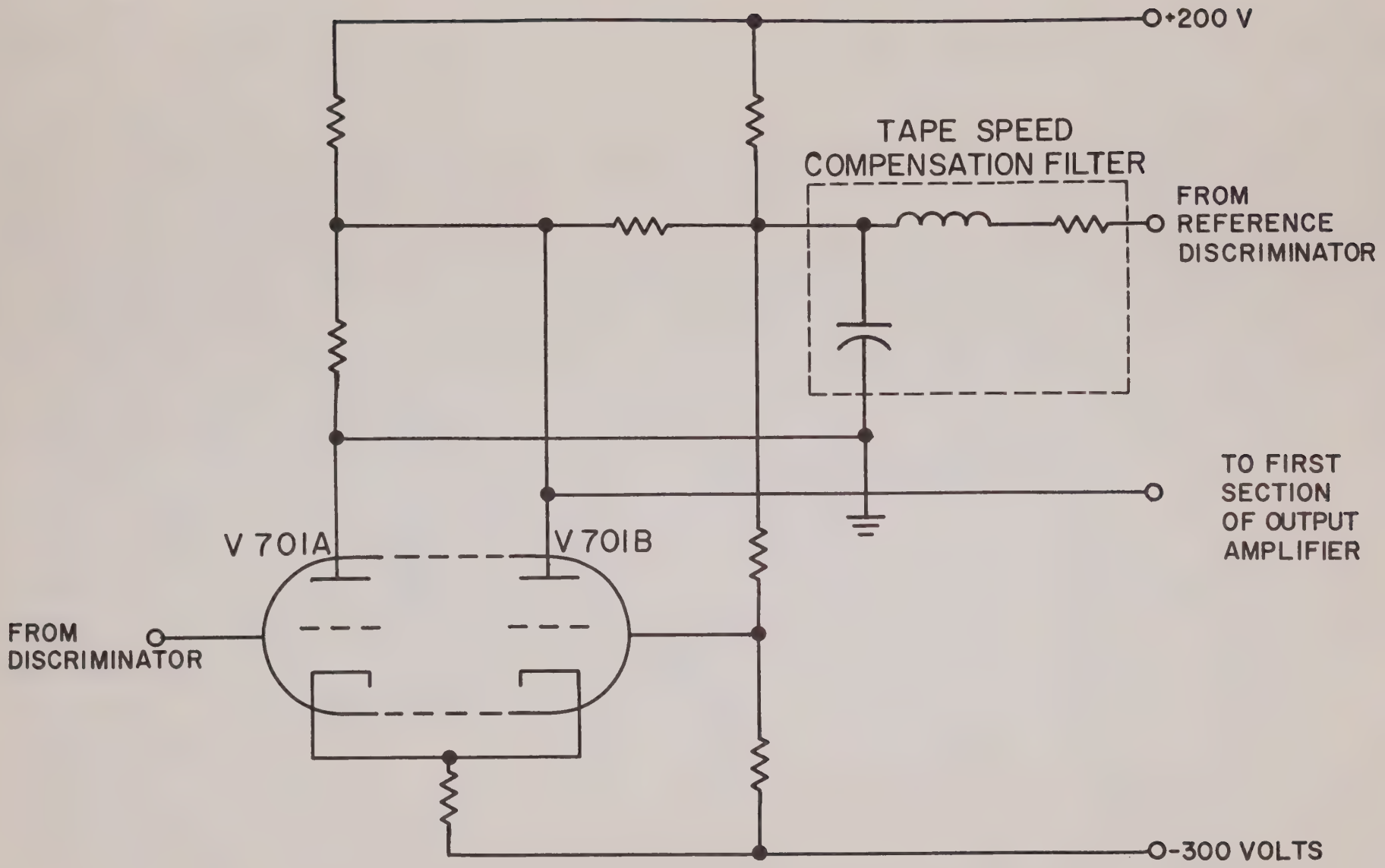


FIG. 6 CURRENT SWITCH

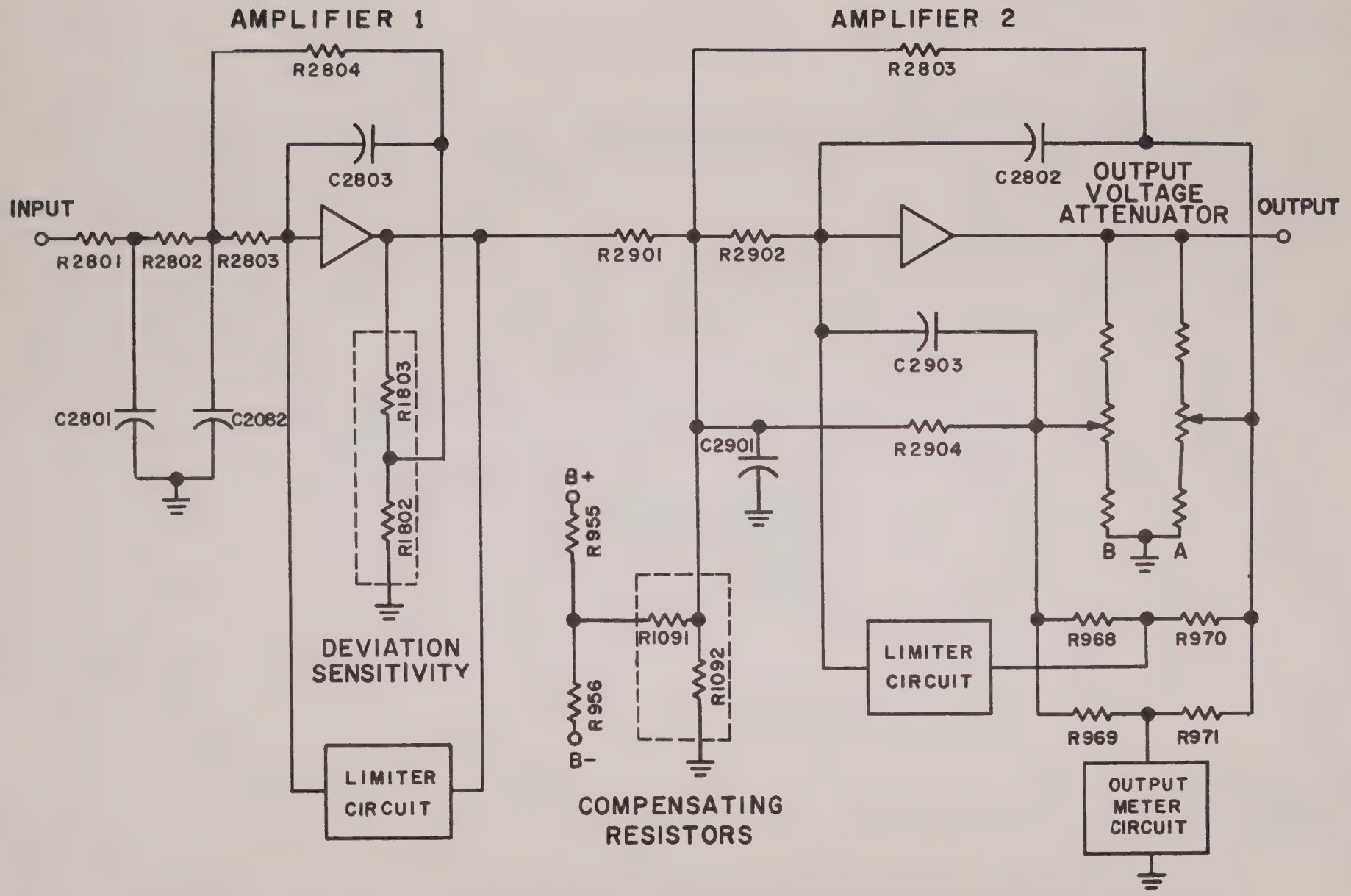
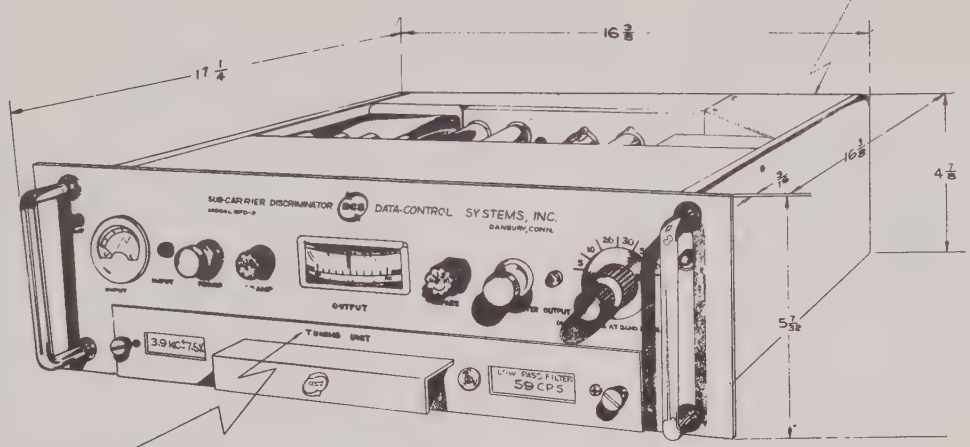
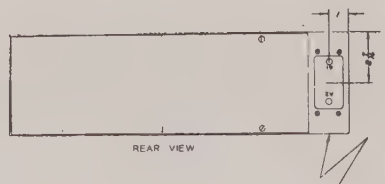
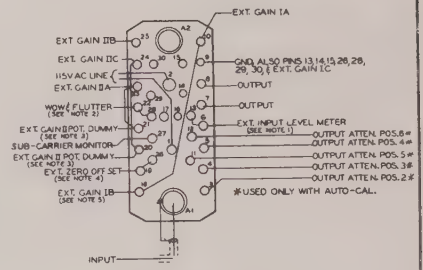


FIG. 7 OUTPUT FILTER SYSTEM





CONNECTOR LOCATED AT THIS END.


EXT. GAIN IA
EXT. GAIN IIB
EXT. GAIN IIC
115V AC LINE
EXT. GAIN IIA
WOW & FLUTTER (SEE NOTE 2)
EXT. GAIN II POT. DUMMY (SEE NOTE 3)
SUB-CARRIER MONITOR
EXT. GAIN II POT. DUMMY (SEE NOTE 3)
EXT. ZERO OFF SET (SEE NOTE 4)
EXT. GAIN IB (SEE NOTE 5)
GND. ALSO PINS 13,14,15,26,28, 29, 30 & EXT. GAIN IC
OUTPUT
OUTPUT
EXT. INPUT LEVEL METER (SEE NOTE 1)
OUTPUT ATTEN. POS. 8 *
OUTPUT ATTEN. POS. 4 *
OUTPUT ATTEN. POS. 5 *
OUTPUT ATTEN. POS. 3 *
OUTPUT ATTEN. POS. 2 *
* USED ONLY WITH AUTO-CAL.
INPUT

P101
DCS PART NO. 80-005070

NOTES:

1. IF EXTERNAL INPUT LEVEL METER IS USED, REMOVE THIS JUMPER AND CONNECT METER FROM PIN 6 TO PIN 13.

2. CONNECT PIN 22 TO PIN 28 WHEN WOW & FLUTTER INPUT IS NOT USED.

3. CONNECT PIN 21 TO PIN 23, AND PIN 20 TO PIN 24 WHEN AUTO-CALIBRATION IS NOT USED.

4. FOR EXTERNAL ZERO OFFSET, REMOVE JUMPER AND INSERT EXTERNAL VOLTAGE BETWEEN PINS 19 & 26.

5. FOR EXTERNAL GAIN CONTROL REMOVE JUMPER AND INSTALL APPROPRIATE GAIN DETERMINING NETWORK.

6. IF TAPE SPEED COMPENSATED, PIN 22 IS CONNECTED TO OUTPUT OF REFERENCE DISCRIMINATOR (PIN 7).

NOTE

TUNING UNIT NOT SUPPLIED AS A COMPONENT OF BASIC GFD-2 ASSEMBLY, BUT IS AVAILABLE FOR INDIVIDUAL CHANNELS AS REQUIRED.

DATA-CONTROL SYSTEMS, INC.

OUTLINE DRAWING
SUB-CARRIER DISCRIMINATOR

DO NOT SCALE DRAWING

GFD-2 | DO-005003 | 03

BAND PASS AMPLIFIER - 1ST LIMITER

1ST LIMITER - 2ND LIMITER

BISTABLE MULTIVIBRATOR

TIME-BASE GENERATOR

COMPARATOR

12AT7 V201A V201B — 12AT7 V202A V202B — 12AT7 V203A V203B — 6AU6 V301 — 6U8A V302A V302B — 6AB4 V303 — 12AT7 V304A V304B — 6U8A V401A V401B — 6AU6 V402 — 6AU6 V403 — 6AB4 V501 — 6AU6 V502 — 5965 V601A V601B

12AT7 — ECC83/12AX7 — ECC83/12AX7 — 6U8A — 12AX7 — 12AX7 — 6U8A V903B — 6CL6 V905 — 6CL6 V904

V701A V701B — V801A V801B — V802A V802B — V803A V803B — V901A V901B — V902A V902B — V903A

+200V REG — -300V REG — +420V REG — +285V UNREG — -285V UNREG — -420V UNREG

INPUT — OUTPUT J7 — J5 — J6 SUB-CARRIER MONITOR — J1 (P2) INPUT — J2 (P2) — S1 2.0 AMP. SLO BLO

INPUT FILTER — FIRST HALF OF PLUG-IN OUTPUT FILTER — 2ND HALF OF PLUG-IN OUTPUT FILTER J5

CURRENT SWITCH — 1ST D.C. AMPLIFIER — 2ND D.C. AMPLIFIER — ATTENUATOR SWITCH

EXT. ZERO OFFSET — EXT. GAIN 1A — EXT. GAIN 1B

R955 300K .1% WW EPR — R956 450K .1% WW EPR — R1901 — R1902 — 1= COMPENSATION

ALL RESISTORS ON S901 ARE 1W 1%

OUTPUT LEVELS S 901 POSITIONS

1. 10 VOLTS
2. 5 TO 10 VOLTS
3. 10 TO 20 VOLTS
4. 20 TO 30 VOLTS
5. 30 TO 50 VOLTS
6. 50 TO 90 VOLTS
7. EXTERNAL

1 - NC
2 - 3 on J1
3 - 4 on J1
4 - 5 on J1
5 - 11 on J1
6 - 12 on J1
7 - NC

1 N.C. — 7 NC

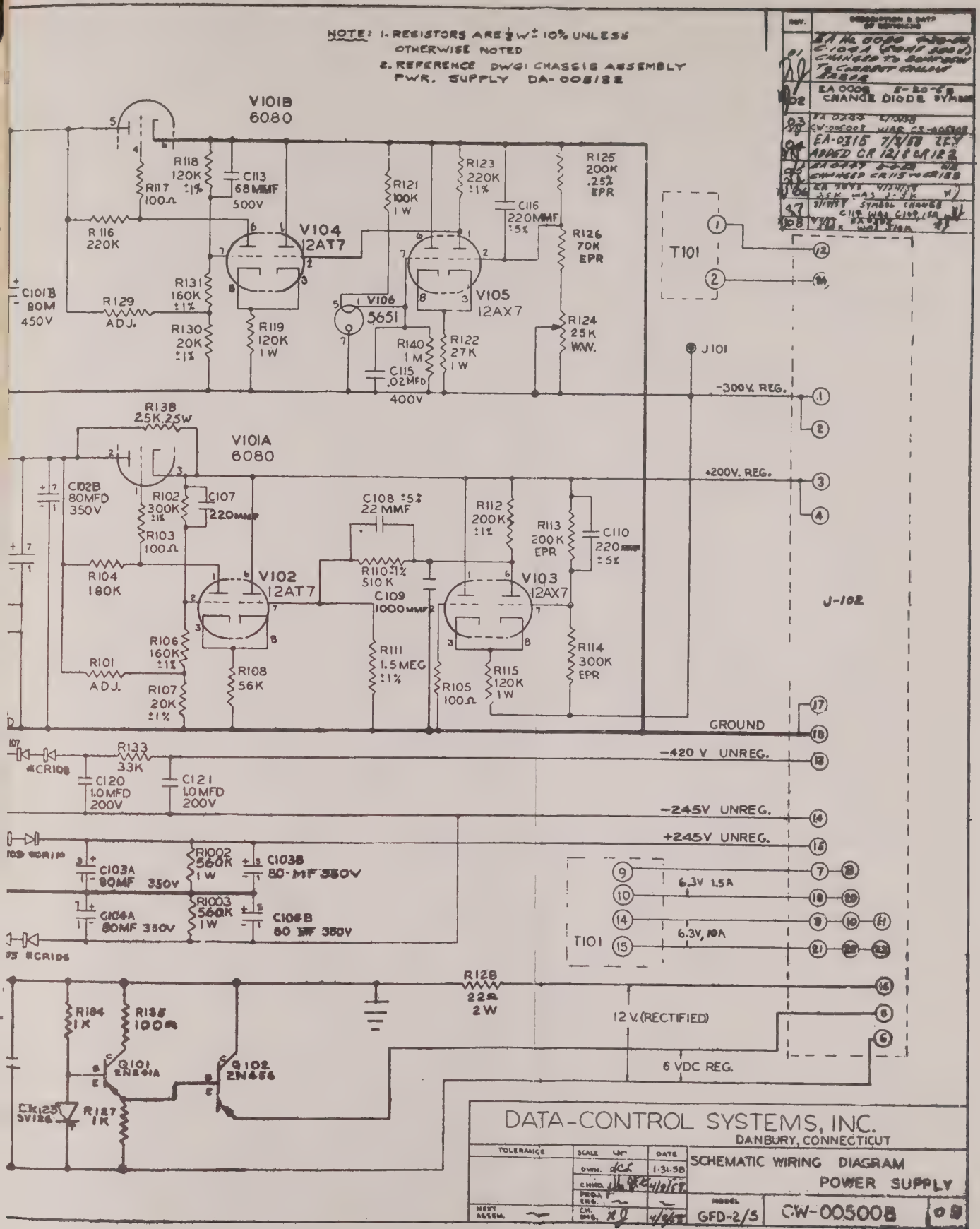
FILAMENT CHART

UNREG DC	REG. SUPPLY	-200	GROUND
			V201
			V202
			V203
			V301
			V302
			V303
			V304
			V401
V402			
V403			
V501			
V502			
V601			
V701			
V801			
V802		V803	V804
			V805
			V901
			V902
			V903
			V904
			V905

J2 1-3 +300V UNREG
J2 1-2 -300V REG
J2 14 +285 V UNREG
J2 15 -285V UNREG
J2 3-4 +200V REG
J2 17-18 GROUND

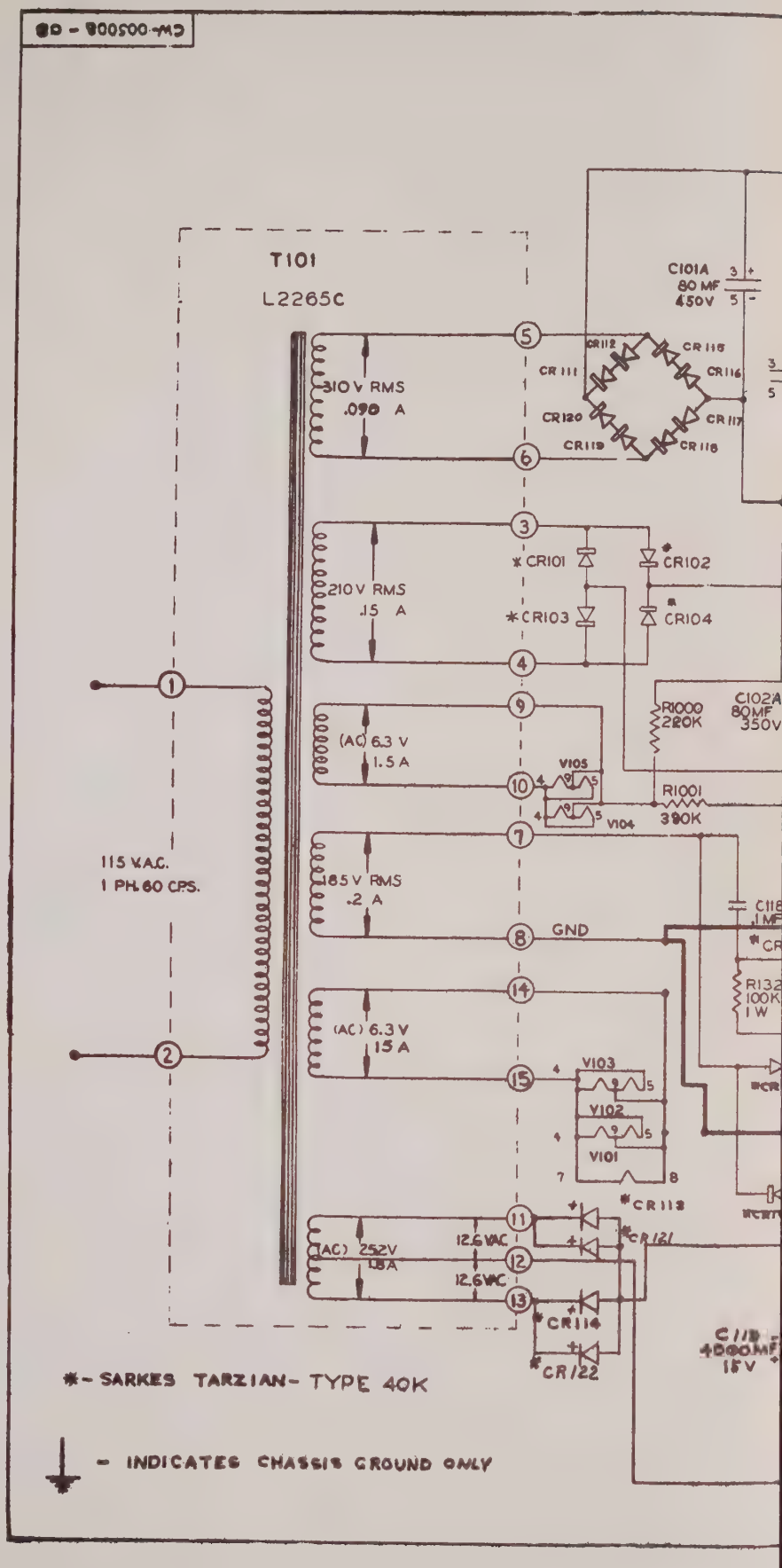
R944 2.5K 1% FROM J1 #20
R945 2.5K 1% FROM J1 #21

BETA CONTROL SYSTEMS, INC.		SCHEMATIC DIAGRAM SUB-CARRIER DISCRIMINATOR	
TOLERANCE	SCALE	DO NOT SCALE DRAWING	
DRWN	DATE	5-CL	7/20
CHKD			
ENGR			
MFG			
QUAL			
NEXT ASSY		GFD-2	RW-005001



REV.	DESCRIPTION & DATE OF REVISION
01	EA No. 0020 7/20/59 C-1021 (CONT 2nd) CHANGED TO CONFORM TO CURRENT CHASSIS WIRING
02	EA 0008 8-20-59 CHANGE DIODE SYMBOL
03	EA 0283 1/13/60 CW-005008 WAS CS-005008
04	EA-0315 7/7/60 LET ADDED CR 121 & CR 122
05	EA 0349 9-2-60 CHANGED CR115 TO CR125
06	EA 0393 3-24-61 SCHEM WAS 2-5-61
07	11/1/61 SYMBOL CHANGE C115 WAS C101B EA 0408 WAS V101
08	V101 EA 0408 WAS V101

DATA-CONTROL SYSTEMS, INC.	DANBURY, CONNECTICUT
TOLERANCE	SCALE UNI
DWN.	DATE 1-31-58
CHKD.	
PROJ. ENG.	
NEXT ASSEM.	CH. ENG.
SCHEMATIC WIRING DIAGRAM POWER SUPPLY	
MODEL GFD-2/S	CW-005008 08


T101
L2265C
115 V.A.C.
1 PH. 60 CPS.
310 V RMS
.090 A
210 V RMS
.15 A
(AC) 6.3 V
1.5 A
185 V RMS
.2 A
(AC) 6.3 V
1.5 A
(AC) 252V
1.8A
12.6 VAC
12.6 VAC
GND
C101A
80 MF
450V
CR111
CR112
CR113
CR114
CR115
CR116
CR117
CR118
CR120
*CR101
*CR102
*CR103
*CR104
R1000
220K
C102A
80MF
350V
R1001
390K
V105
V104
V103
V102
V101
*CR112
*CR121
*CR114
*CR122
C118
1MF
R132
100K
1W
C119
4000MF
15V
*- SARKES TARZIAN- TYPE 40K
- INDICATES CHASSIS GROUND ONLY

SYMBOL	DESCRIPTION	MANUFACTURER	MFR'S TYPE OR PART NO.	QUAN./ UNIT
R201	10 meg. 5% 1/2W	Allen Bradley	EB	1
R202	1.5 meg. 10% 1/2W	Allen Bradley	EB	1
R203	27.4K 1%	Electra	DCM 1/2	1
R204	8.2 meg. 5% 1/2W	Allen Bradley	EB	1
R205	1 meg. 10% 1/2W	Allen Bradley	EB	1
R206	15K 1%	Electra or equivalent*	DCM 1/2	1
R207	2.3 meg. 2%	Allen Bradley	EB	1
R208	1 meg. 10%	Allen Bradley	EB	1
R209	27.4K 1%	Electra or equivalent*	DCM 1/2	1
R210	2.3 meg. 2%	Allen Bradley	EB	1
R211	1 meg. 10%	Allen Bradley	EB	1
R212	27.4K 1%	Electra or equivalent*	DCM 1/2	1
R213	820K 10%	Allen Bradley	EB	1
R214	10 meg. 5% 1/2W	Allen Bradley	EB	1
R215	1.8K 10% 1/2W	Allen Bradley	EB	1
R217	2.3 meg. 2%	Allen Bradley	EB	1
R218	90.9K 1%	Electra or equivalent*	DCM 1/2	1
R219	2.2 meg. 10% 1/2W	Allen Bradley	EB	1
R220	47K 10% 1/2W	Allen Bradley	EB	1
R221	10K 1% 1/2W	Electra or equivalent*	DCM 1/2	1
R222	1% 1K	Allen Bradley	EB	1

*EQUIVALENT TO BE:
Electra Dipped Type Series 125 CF1/2
Texas Instrument Dipped Type CD 1/2PR, CD 1/2MR
Texas Instrument Molded Type CDM 1/2

SYMBOL	DESCRIPTION	MANUFACTURER	MFR'S TYPE OR PART NO.	QUAN./ UNIT
R223	1.5 meg. 10%	Allen Bradley	EB	1
R224	10K 1/2W 1%	Texas Instrument	--	1
R225 226 227 228 229 230	100 ohm 10% 1/2W	Allen Bradley	EB	6
R231	100K 1/2W 10%	Allen Bradley	EB	1
R237	15K 10% 1/2W	Allen Bradley	EB	1
R301	10.0K 1% 1/2W	Electra or equivalent*	DCM 1/2	1
R302	100 ohms 10% 1/2W	Allen Bradley	EB	1
R303	47K 10% 1/2W	Allen Bradley	EB	1
R304	150K 10% 1/2W	Allen Bradley	EB	1
R306	1 meg. 10% 1/2W	Allen Bradley	EB	1
R307	100 ohms. 10% 1/2W	Allen Bradley	EB	1
R308	33K 10% 1/2W	Allen Bradley	EB	1
R309	499 ohms 1% 1/2W	Electra or equivalent*	DCM 1/2	1
R310	499 ohms 1% 1/2W	Electra or equivalent*	DCS 1/2	1
R311	100K 10% 2W	Allen Bradley	HB	1
R312	1K 10% 1/2W	Allen Bradley	EB	1
R313	1M 10% 1/2W	Allen Bradley	EB	1

*EQUIVALENT TO BE:
Electra Dipped Type Series 125 CF1/2
Texas Instrument Dipped Type CD 1/2PR, CD 1/2MR
Texas Instrument Molded Type CDM 1/2

SYMBOL	DESCRIPTION	MANUFACTURER	MFR'S TYPE OR PART NO.	QUAN./ UNIT
R314	100K 10% 1/2W	Allen Bradley	EB	1
R315	10K 1/2W 1%	Electra or equivalent*	DCM 1/2	1
R316	100 ohms 10% 1/2W	Allen Bradley	EB	1
R317	47K 1/2W 10%	Allen Bradley	EB	1
R318	220K 10% 1/2W	Allen Bradley	EB	1
R319	332K 1% 1/2W	Electra or equivalent*	DCM 1/2	1
R320	1M 10% 1/2W	Allen Bradley	EB	1
R321	33K 10% 1/2W	Allen Bradley	EB	1
R322	1 meg. 10% 1/2W	Allen Bradley	EB	1
R323	4.3K 1/2W 1%	Electra or equivalent*	DCM 1/2	1
R324	3K 1/2W 1%	Electra or equivalent*	DCM 1/2	1
R325	82K 10% 2W	Allen Bradley	HB	1
R326	10K 10% 1/2W	Allen Bradley	EB	1
R327	1 meg. 10% 1/2W	Allen Bradley	EB	1
R328	100K 10% 1/2W	Allen Bradley	EB	1
R329	200K 1/2W 1%	Electra or equivalent*	DCM 1/2	1
R330	47K 10% 1/2W	Allen Bradley	EB	1
R331	56K 10% 1/2W	Allen Bradley	EB	1
R332	18K 1% 1W	Constanta	N3	1
R333	240K 1/2W 1%	Electra or equivalent*	DCM 1/2	1
R334	1.5K 1/2W 1%	Electra or equivalent*	DCM 1/2	1
R335	1.5 meg. 1/2W 1%	Electra or equivalent*	DCM 1/2	1

*EQUIVALENT TO BE:
Electra Dipped Type Series 125 CF1/2
Texas Instrument Dipped Type CD 1/2PR, CD 1/2MR
Texas Instrument Molded Type CDM 1/2

SYMBOL	DESCRIPTION	MANUFACTURER	MFR'S TYPE OR PART NO.	QUAN./ UNIT
R336	100 ohms 10% 1/2W	Allen Bradley	EB	1
R338	390K 10% 1/2W	Allen Bradley	EB	1
R401	2.21 meg. 1/2W 1%	Electra or equivalent*	DCM 1/2	1
R402	150K 1/2W 1%	Electra or equivalent*	DCM 1/2	1
R403	15K 5W 1%	Mepco	P5	1
R404	182K 1/2W 1%	Electra or equivalent*	DCM 1/2	1
R405	1.0 meg. 1/2W 1%	Electra or equivalent*	DCM 1/2	1
R406	5.11K 1/2W 1%	Electra or equivalent*	DCM 1/2	1
R407	5.11K 1/2W 1%	Electra or equivalent*	DCM 1/2	1
R408	200K 1% 1W	Constanta	N3	1
R409	562K 1/2W 1%	Electra or equivalent*	DCM1/2	1
R410	1.5K 1% 1/2W	Electra or equivalent*	DCM 1/2	1
R411	3.3K 3W 1%	Mepco	P3	1
R412	7.5K 5W 1%	Mepco	P5	1
R413	5.11K 1/2W 1%	Electra or equivalent*	DCM 1/2	1
R414	200K 1% 1W	Constanta	N3	1
R415	100K 1/2W 1%	Constanta	N3	1
R416	39K 2W 10%	Allen Bradley	HB	1
R417	10K 5W 1%	Mepco	P5	1
R418	82.5K 1/2W 1%	Electra or equivalent*	DCM 1/2	1
R419	1 meg. 1% 1/2W	Vamistor (Weston Mfg.)	9851	1

*EQUIVALENT TO BE:
Electra Dipped Type Series 125 CF 1/2
Texas Instrument Dipped Type CD 1/2PR, CD 1/2MR
Texas Instrument Molded Type CDM 1/2

SYMBOL	DESCRIPTION	MANUFACTURER	MFR'S TYPE OR PART NO.	QUAN./ UNIT
R420	4.75 meg. 1/2W 1%	Electra or equivalent*	DCM 1/2	1
R421	8.25K 1/2W 1%	Electra or equivalent*	DCM 1/2	1
R422	475K 1/2W 1%	Electra or equivalent*	DCM 1/2	1
R501	100 ohms 10% 1/2W	Allen Bradley	EB	1
R502	820K 1% 1/2W	Vamistor(Weston Mfg.)	9851	1
R503	8.2K 1% 3W	Mepco	P3	1
R504	15K 1% 5W	Mepco	P5	1
R506	100 ohms 10% 1/2W	Allen Bradley	EB	1
R507	150K 10% 2W	Allen Bradley	HB	1
R508	100 ohms 10% 1/2W	Allen Bradley	EB	1
R509	100K 1/10% 1W	Eastern Precision Reisitor	NS-6DR	1
R511	10K 1% 5W	Mepco	P5	1
R512	162K 1/2W 1%	Electra or equivalent*	DCM 1/2	1
R513	121K 1/2W 1%	Electra or equivalent*	DCM 1/2	1
R514	15K 1% 5W	Mepco	P5	1
R515	100 ohms 10% 1/2W	Allen Bradley	EB	1
R516	100 ohms 10% 1/2W	Allen Bradley	EB	1
R517	100 ohms 10% 1/2W	Allen Bradley	EB	1
R601	25K .1% 1W	Eastern Precision Resistor	NS-6DR	1
R602	10K 1% 5W	Mepco	P5	1

*EQUIVALENTS TO BE:
Electra Dipped Type Series 125 CF 1/2
Texas Instrument Dipped Type CD 1/2PR, CD 1/2MR
Texas Instrument Molded Type CDM 1/2

SYMBOL	DESCRIPTION	MANUFACTURER	MFR'S TYPE OR PART NO.	QUAN./ UNIT
R603	39.2K 1/2W 1%	Electra or equivalent*	DCM,1/2	1
R604	100K 1% 1W	Eastern Precision Resistor	NS-6DR	1
R605	100K 1% 1W	Eastern Precision Resistor	NS-6DR	1
R702	35.29K 1/10% 1/2W	Eastern Precision Resistor	NS-6BR	1
R703	200K 1/10% 1W	Eastern Precision Resistor	NS-6BR	1
R704	100.5K 1/10% 1W	Eastern Precision Resistor	NS-6BR	1
R705	428.6K 1/10% 1/2W	Eastern Precision Resistor	NS-6B	1
R706	0.2W 1% 150K	Eastern Precision Resistor	NS-6AW	1
R801	1/2W 10% 470K	Allen Bradley	EB	1
R802	470K 10% 1/2W	Allen Bradley	EB	1
R803	5.6 meg. 10% 1/2W	Allen Bradley	EB	1
R804	220K 10% 1/2W	Allen Bradley	EB	1
R805	220K 10% 1/2W	Allen Bradley	EB	1
R806	5.6 meg. 10% 1/2W	Allen Bradley	EB	1
R807	100K 10% 1/2W	Allen Bradley	EB	1
R808	5.6 meg. 10% 1/2W	Allen Bradley	EB	1
R809	2.43K 1% 1/2W	Electra or equivalent*	DCM 1/2	1
R810	620K 10% 1/2W	Allen Bradley	EB	1
R811	100K 10% 1/2W	Allen Bradley	EB	1
R812	5.6 meg. 10% 1/2W	Allen Bradley	EB	1
R813	5.6 meg. 10% 1/2W	Allen Bradley	EB	1

*EQUIVALENT TO BE:
Electra Dipped Type Series 125 CF 1/2
Texas Instrument Dipped Type CD 1/2PR, CD 1/2MR
Texas Instrument Molded Type CDM 1/2

SYMBOL	DESCRIPTION	MANUFACTURER	MFR'S TYPE OR PART NO.	QUAN./ UNIT
R814	100 ohm 10% 1/2W	Allen Bradley	EB	1
R815	510K 1/2W 5%	Allen Bradley	EB	1
R816	330 ohm 1/2W 10%	Allen Bradley	EB	1
R817	1.5 meg 10% 1/2W	Allen Bradley	EB	1
R818	100K 10% 1/2W	Allen Bradley	EB	1
R819	150K 10% 1/2W	Allen Bradley	EB	1
R820	1/2W 10% 220 ohms	Allen Bradley	EB	1
R821	4.7K 1/2W 10%	Allen Bradley	EB	1
R822	180K 10% 1/2W	Allen Bradley	EB	1
R823	1/2W 10% 12K	Allen Bradley	EB	1
R824	8.25K 1/2W 1%	Electra or equivalent*	DCM 1/2	1
R825	820K 10% 1/2W	Allen Bradley	EB	1
R826	100 ohm 10% 1/2W	Allen Bradley	EB	1
R827	30K 5W 5%	Sprague	27E	1
R828	300K 1/2W 1%	Electra or equivalent*	DCM 1/2	1
R829	200K 1/2W 1%	Electra or equivalent*	DCM 1/2	1
R830	16.2K 1/2W 1%	Electra or equivalent*	DCM 1/2	1
R831	16.2K 1/2W 1%	Electra or equivalent*	DCM 1/2	1
R833	560K 10% 1/2W	Allen Bradley	EB	1
R901	470K 10% 1/2W	Allen Bradley	EB	1
R902	499K 1/2W 1%	Electra or equivalent*	DCM 1/2	1
R903	470K 1/2W 10%	Allen Bradley	EB	1
R904	2.37K 1% 1/2W	Electra or equivalent*	DCM 1/2	1

*EQUIVALENT TO BE:
Electra Dipped Type Series 125 CF 1/2
Texas Instrument Dipped Type CD 1/2PR, CD 1/2MR
Texas Instrument Molded Type CDM 1/2

SYMBOL	DESCRIPTION	MANUFACTURER	MFR'S TYPE OR PART NO.	QUAN./ UNIT
R905	5.6 meg. 10% 1/2W	Allen Bradley	EB	1
R906	220K 1/2W 10%	Allen Bradley	EB	1
R907	220K 1/2W 10%	Allen Bradley	EB	1
R908	5.6 meg. 10% 1/2W	Allen Bradley	EB	1
R909	619K 1% 1/2W	Electra or equivalent*	DCM 1/2	1
R910	100K 10% 1/2W	Allen Bradley	EB	1
R911	2 meg. 10% 1/2W	Allen Bradley	EB	1
R912	100 ohm 10% 1/2W	Allen Bradley	EB	1
R913	110K 10% 2W	Allen Bradley	HB	1
R914	5.6 meg 1/2W 10%	Allen Bradley	EB	1
R915	100K 1/2W 10%	Allen Bradley	EB	1
R916	510K ≠5% 1/2W	Allen Bradley	EB	1
R917	68K 1/2W 10%	Allen Bradley	EB	1
R918	100K 1/2W 10%	Allen Bradley	EB	1
R919	3.9K 10% 1/2W	Allen Bradley	EB	1
R920	1.3 meg. 10% 1/2W	Allen Bradley	EB	1
R921	39K 1/2W 10%	Allen Bradley	EB	1
R922	100 ohm 10% 1/2W	Allen Bradley	EB	1
R923	10K 1% 1/2W	Electra or equivalent*	DCM 1/2	1
R924	1 meg. 10% 1/2W	Allen Bradley	EB	1
R925	510K ≠5% 1/2W	Allen Bradley	EB	1
R926	470 ohms 10% 2%	Allen Bradley	HB	1
R927	150 ohms 10% 1/2W	Allen Bradley	EB	1

*EQUIVALENT TO BE:
Electra Dipped Type Series 125 CF 1/2
Texas Instrument Dipped Type CD 1/2PR, CD 1/2MR
Texas Instrument Molded Type CDM 1/2

SYMBOL	DESCRIPTION	MANUFACTURER	MFR'S TYPE OR PART NO.	QUAN./ UNIT
R928	150 ohms 10% 1/2W	Allen Bradley	EB	1
R929	510K ±5% 1/2W	Allen Bradley	EB	1
R930	10K 10% 2W	Allen Bradley	HB	1
R931	19.6K 1% 1/2W	Electra or equivalent*	DCM 1/2	1
R932	63.4K 1% 1/2W	Electra or equivalent*	DCM 1/2	1
R933	1.3K 1% 1/2W	Electra or equivalent*	DCM 1/2	1
R934	357 ohms 1% 1/2W	Electra or equivalent*	DCM 1/2	1
R935	866 ohms 1% 1/2W	Electra or equivalent*	DCM 1/2	1
R936	3.4K 1% 1/2W	Electra or equivalent*	DCM 1/2	1
R937	931 ohms 1% 1/2W	Electra or equivalent*	DCM 1/2	1
R939	13.7K 1% 1/2W	Electra or equivalent*	DCM 1/2	1
R940	1.21K 1% 1/2W	Electra or equivalent*	DCM 1/2	1
R941	22.1K 1% 1/2W	Electra or equivalent*	DCM 1/2	1
R942	1.3K 1% 1/2W	Electra or equivalent*	DCM 1/2	1
R943	34.8K 1% 1/2W	Electra or equivalent*	DCM 1/2	1
R944	1/2W 1% 2.49K	Electra or equivalent*	DCM 1/2	1
R945	1/2W 1% 2.49K	Electra or equivalent*	DCM 1/2	1
R946	499 ohms 1% 1/2W	Electra or equivalent*	DCM 1/2	1
R947	1.91K 1% 1/2W	Electra or equivalent*	DCM 1/2	1
R948	1.91K 1% 1/2W	Electra or equivalent*	DCM 1/2	1
R949	6.34K 1% 1/2W	Electra or equivalent*	DCM 1/2	1
R950	6.34K 1% 1/2W	Electra or equivalent*	DCM 1/2	1
R951	4.42K 1% 1/2W	Electra or equivalent*	DCM 1/2	1

*EQUIVALENT TO BE:
Electra Dipped Type Series 125 CF 1/2
Texas Instrument Dipped Type CD 1/2PR, CD 1/2MR
Texas Instrument Molded Type CDM 1/2

SYMBOL	DESCRIPTION	MANUFACTURER	MFR'S TYPE OR PART NO.	QUAN./ UNIT
R952	18.2K 1% 1/2W	Electra or equivalent*	DCM 1/2	1
R953	2.1K 1% 1/2W	Electra or equivalent*	DCM 1/2	1
R954	39.2K 1% 1/2W	Electra or equivalent*	DCM 1/2	1
R955	300K .1% 1W	Eastern Precision Resistor	NS-6DR	1
R956	450K 10% 1W	Eastern Precision Resistor	NS-6D	1
R957	1K 10% 1/2W	Allen Bradley	EB	1
R964	1 meg 1/2W 1%	Electra or equivalent*	DCM 1/2	1
R965	23.2K 1/2W 1%	Electra or equivalent*	DCM 1/2	1
R966	23.2K 1/2W 1%	Electra or equivalent*	DCM 1/2	1
R967	1.5 meg 1/2W 1%	Electra or equivalent*	DCM 1/2	1
R968	124K 1/2W 1%	Texas Instrument	CDM 1/2	1
R969	49.9K 1/2W 1%	Texas Instrument	CDM 1/2	1
R970	24.9K 1/2W 1%	Texas Instrument	CDM 1/2	1
R971	10K 1/2W 1% Composition	Texas Instrument	------	1
R972	20K 1/2W 1%	Texas Instrument	CDM 1/2	1
R974	220 ohms 10% 1/2W	Allen Bradley	EB	1
R980	1/2W 10% 330 ohms	Allen Bradley	EB	1
	2 x 1 mfd 600V	Cornell Dubilier	DYR6110J	1
C201 C202 C203 C204 C205	.01 mfd 20% 400V	Aerovox	V84B	5

*EQUIVALENT TO BE:
Electra Dipped Type Series 125 CF 1/2
Texas Instrument Dipped Type CD 1/2PR, CD 1/2MR
Texas Instrument Molded Type CDM 1/2

SYMBOL	DESCRIPTION	MANUFACTURER	MFR'S TYPE OR PART NO.	QUAN./ UNIT
C206	.047 mfd. 20% 400V	Aerovox	V84B	1
C207	250 V 15 mfd	Illinois	SMT15250	1
C208	.022 mfd 20% 200V	Aerovox	V84B	1
C209	.1 mfd 20% 200V	Aerovox	V84B	2
C210				
C301	.22 mfd 20% 200V	Aerovox	V84B	1
C302	.047 mmfd 20% 400V	Aerovox	V84B	1
C303	33 mmfd 5% 500V	Dur-Mica	DM15	1
C304	.15 mfd 20% 200V	Aerovox	V84B	1
C305	.047 mmfd. 20% 400V	Aerovox	V84B	1
C306	33 mmfd 500%	Dur-Mica	DM15	1
C307	.047 mfd. 20% 400V	Aerovox	V84B	1
C308	5 mmfd 5% 500V	Dur-Mica	DM15	1
C309	.047 mfd. 20% 400V	Aerovox	V84B	1
C310	.1 mfd 20% 200V	Aerovox	V84B	1
C311	10 mmfd 5% 500V	Dur-Mica	DM15	1
C312	22 mmfd 5% 500V	Dur-Mica	DM15	1
C401				
C402	5 mmfd 5% 500V	Dur-Mica	DM15	2
C403	.1 mfd 20% 400V	Aerovox	V84B	1
C404	407 mmfd 5% 500V	Dur-Mica	DM19	1
C405	47 mmfd 5% 500V	Dur-Mica	DM15	1
C406	.1 mfd 20% 400V	Aerovox	V84B	2
C407	7 mmfd 5% 500V	Dur-Mica	DM15	1
C408	22 mmfd 5% 500V	Dur-Mica	DM15	1

SYMBOL	DESCRIPTION	MANUFACTURER	MFR'S TYPE OR PART NO.	QUAN./ UNIT
C501	.1 mfd 20% 150V	Aerovox	V84B	1
C502	2200 mfd. 5% 500V	Dur-Mica	DM19	1
C503	6 mmfd ±.5 mmfd. ±15% PPM/°C	Electra or equivalent*	N2200	1
C601	10 mmfd 5% 500V	Dur-Mica	DM15	1
C801	.01 mfd. 20% 400V	Aerovox	V84B	1
C802 C803	.047 mfd 20% 400V	Aerovox	V84B	2
C804	220 mmfd 5% 500V	Dur-Mica	DM15	1
C805	.047 mfd 20% 400V	Aerovox	V84B	1
C806	1 mfd 20% 150V	Aerovox	V84B	1
C807	.22 mfd 20% 200V	Aerovox	V84B	1
C808	47 mmfd 5% 500V	Dur-Mica	DM15	1
C809	220 mmfd 5% 500V	Dur-Mica	DM15	1
C810	.1 mfd 20% 200V	Aerovox	V84B	1
C811	22 mmfd 5% 500V	Dur-Mica	DM15	1
C812	33 mmfd 2% 500V	Dur-Mica	DM15	1
C813	1.0 mfd 20% 400V	Aerovox	JP16MCB	1
C901	.01 mfd 20% 400V	Aerovox	V84B	1
C902	.047 mfd 20% 400V	Aerovox	V84B	1
C903	.047 mfd 20% 400V	Aerovox	V84B	1

*EQUIVALENT TO BE:
Electra Dipped Type Series 125 CF 1/2
Texas Instrument Dipped Type CD 1/2PR, CD 1/2MR
Texas Instrument Molded Type CDM 1/2

SYMBOL	DESCRIPTION	MANUFACTURER	MFR'S TYPE OR PART NO.	QUAN./ UNIT
C904	220 mmfd. 5% 500V	Dur-Mica	DM15	1
C905	.047 mfd. 20% 400V	Aerovox	V84B	1
C906	1 mfd 20% 150V	Aerovox	V84B	1
C907	.22 mfd 20% 200V	Aerovox	V84B	1
C908	680 mmfd. 5% 500V	Dur-Mica	DM19	1
C909	.1 mfd 20% 200V	Aerovox	V84B	1
C910	33 mmfd 5% 500V	Dur-Mica	DM15	1
C911	330 mmfd 5% 500V	Dur-Mica	DM15	1
C912	1000 mmfd 5% 500V	Dur-Mica	DM15	1
C913	3300 mmfd 5% 500V	Dur-Mica	DM20	1
C914	1500 mmfd 5% 500V	Dur-Mica	DM19	1
C915	470 mmfd 5% 500V	Dur-Mica	DM19	1
C916	220 mmfd 5% 500V	Dur-Mica	DM15	1
C917	180 mmfd 5% 500V	Dur-Mica	DM15	1
C918 C919 C920 C921	33 mmfd 5% 500V	Dur-Mica	DM15	4
C922	1500 mmfd 5% 500V	Dur-Mica	DM19	1
C923	.1 mfd 20% 200V	Aerovox	V84B	1
C924	47 mmfd 10% 500V	Dur-Mica	DM15	1
C930	2200 mmfd 20% 500V	Dur-Mica	DM19	1
L901	Coil	Miller	6146-TV or, 6144-TV or, 6147-TV	
CR201	Diode (Silicon)	Transitron	S5G	1
CR301 CR302	Diode	Transitron	S5G	2

SYMBOL	DESCRIPTION	MANUFACTURER	MFR'S TYPE OR PART NO.	QUAN./ UNIT
CR303 CR304 CR305	Diode	Transitron	S5G	3
CR401	Diode	Hughes	1N625	1
CR402	Diode	Hughes	1N629	1
CR403	Diode	U. S. Semiconductor	LPZ82	1
CR404 CR405	Diode	Hughes	1N625	2
CR801	Diode	Hoffman-Zener	ZA40	1
CR802 CR803 CR804 CR805	Diode	Hughes	1N456	4
CR901 CR902	Diode	Hughes	1N456	2
CR903	Diode	Hoffman Zener	1N474	1
N201	Meter (Input) 0-100 Micro Amps	International	150C	1
M901	Meter (Meter face for Model 1135 Meter)	International	1135HBC240DCUA	1
S1	Switch	Hetherington	J6220R-CF	1
S201	Switch	Hetherington	J6220G-CF	1
F1	Fuse 2 amps Slo-Blo	Littelfuse	3AG	2
V201 V202 V203	Tube		12AT7	3
V301	Tube		6AU6	1
V302	Tube		6U8A	1
V303	Tube		6AB4	1
V304	Tube		12AT7	1

SYMBOL	DESCRIPTION	MANUFACTURER	MFR'S TYPE OR PART NO.	QUAN./ UNIT
V401	Tube		6U8A	1
V402 V403	Tube		6AU6	2
V501	Tube		6AB4	1
V502	Tube	General Electric or Raytheon	6136	1
V503	Tube		6201	1
V601	Tube		5965	1
V701	Tube		12AT7	1
V801	Tube		ECC83/12AX7	1
V802	Tube		ECC83/12AX7	1
V803	Tube		6U8A	1
V901	Tube		ECC83/12AX7	1
V902	Tube		ECC83/12AX7	1
V903	Tube		6U8A	1
V904 V905	Tube		6EL6	2
	Chopper	Stevens Arnold	A-11-11	

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SUBJECT: SUBCARRIER DISCRIMINATOR

MODEL: GFD-2

FUNCTION

The Model GFD-2 Subcarrier Discriminator and its associated filters select and demodulate a particular frequency-modulated signal from among a multiplex of several frequency-modulated signals. It is often employed in data systems based on standard IRIG* FM/FM subcarrier frequencies. It usually receives its input signal from a radio receiver or tape recorder, although it will work from any source of a frequency-modulated signal. The discriminator output signal may be viewed directly or applied to any convenient display or recording device, such as a pen-motor or galvanometer-type recorder. The associated plug-in filter units incorporate provision for automatic compensation for variations in tape speed when a reference frequency has been previously recorded.

DESCRIPTION

The Model GFD-2 Subcarrier Discriminator is designed in modular form for rack mounting. The associated Tuning Unit (Model GFD-2/TU and GFD-2/TUU) which adapt the basic discriminator to any of the standard IRIG telemetry bands, or other specified frequencies, and the Model GFD-2/TU/L Low-Pass Filter are inserted into the discriminator from the front panel.

The power supply is of plug-in module design which permits convenient replacement. The unit is designed to operate in a rack layout permitting "chimney" cooling using forced air at an ambient of 40°C. max.

The front panel contains the necessary controls and indicators and are readily accessible and easy to adjust. The front panel is not a structural member of the unit, thus facilitating such operations as paint color or nomenclature modifications.

Printed circuits are used throughout the unit thus insuring a maximum of reliability in operation.

All circuit components and connections are readily accessible for both usual inspections, electrical checks and repairs.

PERFORMANCE SPECIFICATIONS

Subcarrier Frequencies Accommodated: All standard IRIG FM/FM telemetry subcarrier frequencies, or on special order, any center frequency from 100 cps to 150 kc, as determined by choice of this company's associated plug-in Tuning Unit, Model GFD-2/TU-(freq.).

Subcarrier Frequency Deviations Accommodated: ±7 1/2%, ±15%, ±40%, as provided for in IRIG telemetry standards. Other deviations available on special order.

Intelligence Frequencies: Provided for by means of this company's separate low-pass output filter unit, Model GFD-2/TU/L-(freq.), which plugs into the Tuning Unit plug-in. Cut-off frequencies are available over a range of 6 cps to 20 kc, as provided for in IRIG telemetry standards.

Time Delay of Input Filter: The phase shift is held constant over the pass-band to within ±0.4°, centered about 29.4° of intelligence for a modulation index of 5.0 for IRIG channels 1 through 18, and centered about 28.9° for IRIG channels A through E.

Input Filter Amplitude Response: Attentuation is down less than 3 db at the band edges; is down more than 28 db for ±7.5% channels at the band edge frequencies of the two adjacent IRIG channels and is down more than 22 db for ±15% channels.

Harmonic Distortion: Harmonic distortion of reduced data is less than 0.2% for full bandwidth deviations of 7.5% channels at a modulation index of 5.0. Distortion improves as modulation index increases.

Input Characteristics: Input impedance is 900 K shunted by 60 mmf. Automatic level adjustment for inputs from 10 millivolts to 10 volts. Less than 0.5% of band edge voltage peak transient results from a 6 db step change of input level with IRIG intelligence frequency modulation index of 5.0.

Capture Ratio: Maximum crosstalk is down 50 db when the desired subcarrier exceeds by 2 db the amplitude of the adjacent IRIG subcarrier, after the input filter. Input filters permit an adjacent IRIG subcarrier amplitude 25 db greater than the desired subcarrier before crosstalk exceeds 50 db.

*Inter-Range Instrumentation Group

Linearity: Curve of output voltage versus input subcarrier frequency lies within ±0.1% of full bandwidth from the best straight line.

Output Stability: Drift less than 0.5% full bandwidth in 24 hours after a 60 minute warm-up period. (Drift specification improves for lower IRIG channels and for subcarrier deviations in excess of ±7.5%.

Sensitivity Stability: ±0.1% full bandwidth.

Line Voltage Sensitivity: A peak output voltage corresponding to less than 0.3% of bandwidth results from a line voltage step change of 10 volts.

Output Characteristics: Single ended output will deliver 25 ma at full deviation for any selected band edge output voltage. Will tolerate 0.01 mf across the output. Band edge output voltage control switch and potentiometer provide any band edge output voltage between 5 and 90 volts in five ranges. INTERNAL position provides fixed ±10 volts maximum output voltage. EXTERNAL position affords provision for fixed arbitrary maximum output voltage. Automatic limiter limits output voltage to 150% of band edge value for any switch position, under any conditions.

Zero Signal Protection: Along with automatic output voltage limiting as mentioned above, feedback can be installed from the output of the limiter to the output of the band-pass filter. This causes output to return to approximately center frequency when input is below minimum level. Actual response is a fraction of a subcarrier cycle giving a smooth output transition always within the band. The response of this transition is determined by the output filter.

Hysteresis: If a steady input frequency at one band edge is suddenly changed to the other band edge frequency and left there for a period of ten seconds and then returned to the original frequency, the hysteresis observed is less than 0.5% (For testing technique see WSPG Final Report Sub Task 3-1-2 entitled "Discriminator Hysteresis Study" dated 16 Dec. 1957).

Intelligence Frequency Response: Constant amplitude and linear phase responses are available. Both filters are nominally flat and down 3 db at cut-off frequency. Constant amplitude units are five-pole Butterworth configurations with no rise above zero frequency response. Linear phase units are five-pole Gaussian configurations with linear phase characteristics. For flatter response to a desired frequency higher cut-off frequency units may be used in accordance with low-pass filter design specification sheet.

Noise: Less than 0.1% of band edge peak-to-peak value with modulation indices as low as 5.0.

Tape Speed Compensation: An automatic tape speed compensating circuit is built into each discriminator plug-in Tuning Unit for use with this company's Tape Speed Compensation Delay Unit, Model GTC-2. The fixed phase delay characteristic of the Tuning Unit eliminates the need for all manual controls for phase and amplitude adjustment of the compensation signal derived from the recorded reference frequency. No external d-c amplifier is required.

Automatic Standardization: Automatic adjustment of channel zero and gain may be effected by the use of this company's Automatic Standardization Unit, Model GAC-1.

INSTALLATION AND PHYSICAL SPECIFICATIONS

Power Requirements: 105–125 volts a-c, 55–65 cps, single phase, 190 watts.

Dimensions: Front panel, 5 7/32 high x 18 15/16 wide.
Chassis, 4 7/8 high x 16 3/8 wide x 16 1/2 deep.

Weight: 34 pounds without Tuning Unit.
38 pounds with Tuning Unit.

Mounting: Stationary or slide rack mounting. Locked from front panel.

Cooling: Chimney cooling with ambient temperature of 40°C maximum.

Connectors: Main connector is a Cannon DPD-32C2-34P. (Mating connector DPD-32C2-33S is supplied). Accommodates Tuning Unit through Amphenol connectors (2) #24-4100-24S and (1) #26-4100-16S.

Controls and Indicators: "POWER" switch and light; fuse (2A); spare fuse; "INPUT" Level meter; "INPUT" monitor jack; "OUTPUT" level meter; "OUTPUT" monitor jack; output attenuator control.

Construction: Made of finest materials. All metal parts protected against corrosion.

Color: Front panel is standard DCS grey. Other colors available on special order.

ORDERING INFORMATION

Specify: a. DCS Model GFD-2 Subcarrier Discriminator
b. Requirements other than standard.

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SUBJECT: TUNING UNIT

MODEL: GFD-2/TU, GFD-2/TUU

FUNCTION

The Tuning Unit serves four functions, (1) it adapts the associated discriminator to a particular subcarrier, selecting this subcarrier from a multiplex of several such subcarriers; (2) it incorporates provision for the addition of a low-pass intelligence frequency filter module appropriate to the subcarrier; (3) it may contain circuits which provide automatic compensation of the discriminator output for variations in tape speed when used in conjunction with an appropriate tape speed unit; (4) its modular configuration permits convenient interchangeability of tuning units within a subcarrier discriminator FROM THE FRONT PANEL OF THE DISCRIMINATOR, by a simple plug-in action, without the necessity of making any wiring changes. This configuration also facilitates stocking of several tuning units for each discriminator and thus permits maximum flexibility in terms of ability to discriminate all IRIG bands with a minimum investment.

DESCRIPTION

The Model GFD-2/TU and GFD-2/TUU Tuning Units are five-pole band-pass filters designed to be used in a DCS Model GFD-2 FM/FM Subcarrier Discriminator. These Tuning Units are available in all IRIG bands. The frequency and deviation of each unit are marked on the front panel nameplate. Model GFD-2/TU contains the required circuitry for tape speed error compensation ("Compensated"). Model GFD-2/TUU does not contain tape speed error compensation circuitry ("Uncompensated").

The GFD-2/TU and GFD-2/TUU band-pass filters contain a compartment to accommodate the Model GFD-2/TU/L Low Pass Filter. The desired low-pass filter is selected and placed in the tuning unit before it, in turn, is inserted into the GFD-2.

PERFORMANCE SPECIFICATIONS

Tuning Units suitable for IRIG bands 1 through 18 are supplied to accommodate signals of ±7 1/2% deviation from band center. Tuning Units suitable for IRIG bands A through E are supplied to accommodate signals of ±15% deviation from band center. Units corresponding to subcarrier frequencies of 54kc, 27kc, 13.5kc to accommodate signals of 40% deviation are also available. NOTE: 40% DEVIATION UNITS ARE NOT INTENDED FOR USE WITH A SUBCARRIER MULTIPLEX INPUT.

Phase Shift: The phase shift is held constant over the pass-band to within ±0.4 degrees, centered about 29.4 degrees of intelligence for a modulation index of 5.0 for IRIG bands 1 through 18 and centered about 28.9 degrees for IRIG bands A through E.

Attenuation: Attenuation is down less than 3 db at the band edges; down more than 28 db for ±7.5% bands and more than 22 db for ±1.5% bands at the band edge frequencies of the two adjacent IRIG bands.

INSTALLATION AND PHYSICAL SPECIFICATIONS

Power Requirements: None. All necessary connections made through GFD-2 Discriminator.

Dimensions: Front Panel, 2" high x 16" wide.
Chassis, 1 3/8" high x 14 3/4" wide x 4 3/4" deep.

Weight: Mounts to GFD-2 Discriminator with two 1/4 turn fasteners.

Cooling: None required.

Connectors: Connects to GFD-2 through Amphenol #26-4100-16P and #26-4100-24P connectors.

Controls and Indicators: Center frequency adjustment potentiometer on front panel.

Construction: Made of finest materials. All with parts protected against corrosion.

Color: Front panel is clear satin anodize finish. Lettering is black. Front panel nameplate is black with white lettering.

ORDERING INFORMATION

Specify: a) DCS Model GFD-2/TU-(freq. and deviation) (for compensated units) or DCS Model GFD-2/TUU-(freq. and deviation) (for uncompensated units).

b) Other requirements not standard.

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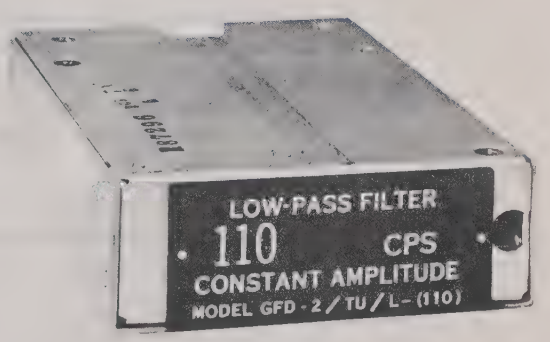
SUBJECT: LOW-PASS FILTER NETWORK

MODEL: GFD-2/TU/L

FUNCTION

The Low-Pass Filter acts upon the output of the DCS Subcarrier Discriminator, Model GFD-2, so as to yield an intelligence signal essentially free of any subcarrier frequency components.



DESCRIPTION

The Low-Pass Filter Network consists of R-C feedback networks connecting into a two-stage chopper-stabilized operational amplifier within the GFD-2 Discriminator. It is modular in configuration and plugs into DCS Tuning Unit, Model GFD-2/TU. DCS Low-Pass Filters are available for all IRIG channels. Any Low-Pass Filter may be used with any Tuning Unit, provided the Low-Pass Filter has a specified cut-off frequency LESS than the highest intelligence frequency recommended in the IRIG Standards. Thus, IRIG channel 5 has a center frequency of 1300 cps and a recommended highest intelligence frequency of 20 cps. Standard Low-Pass Filters suitable for IRIG channels 1 through 5, having cut-off frequencies respectively of 6 cps, 8.4 cps, 11 cps, 14 cps and 20 cps may be used.

PERFORMANCE SPECIFICATIONS

Filter Characteristics: The following types of filter characteristics and their designations are available as standard units:

(1) Constant Amplitude: These filters have an amplitude response according to the expression

$$A(\omega) = \frac{K}{\sqrt{1 + \left(\frac{\omega}{\omega_c}\right)^{10}}}$$

This is a five-pole filter rolling off at 30 db per octave, and at least 30 db down at one octave above nominal cut-off frequency.

At nominal cut-off frequency (ω_c)	$A(\omega) + .707\ A(dc)$
at $.9\omega_c$	$A(\omega) + .86\ A(dc)$
at $.8\omega_c$	$A(\omega) + .95\ A(dc)$
at $.675\omega_c$	$A(\omega) + .99\ A(dc)$

This data may be used to incorporate a higher cut-off frequency unit to obtain flatter response to a desired frequency at the expense of broader noise bandwidth. This unit exhibits a 12% overshoot to a step function.

(2) Linear Phase: This filter approximates the "Gaussian" transfer function $T(\omega)$ through the pass-band to its cut-off frequency:

$$T(\omega) = -\log 10 \frac{3}{20} \left(\frac{\omega}{\omega_c} \right)^2$$

The response characteristic is down 3 db at the nominal cut-off frequency and down 12 db one octave above this cut-off frequency. The asymptotic slope of the filter cut-off characteristic is 30 db per octave. Step function response exhibits less than 1% overshoot. This filter is preferred over the constant amplitude filter where transient response is of primary importance. This type of filter is normally used in commutated data channels where output decommutation equipment is used.

Measured characteristics lie within a rectangle whose amplitude dimension is equal to ±0.25 db and whose frequency dimension is ±1% of cut-off frequency centered about the assumed frequency. For frequencies above 10 kc these dimensions increase to ±1 db and ±5%.

The flatness of the attenuation characteristic associated with a given channel may be improved by using the next higher Low-Pass Filter. This is accomplished, however, at the expense of wider noise bandwidth, as a consequence of the wider intelligence pass-band.

INSTALLATION AND PHYSICAL SPECIFICATIONS

Power Requirements: None. Connects to GFD-2 Discriminator.

Dimensions: 1 1/8" high x 3 1/8" wide x 4 3/4" deep.

Weight: 8 ounces.

Mounting: Fits into compartment in GFD-2/TU Tuning Unit and held in place by spring catch.

Cooling: None required.

Connectors: Connects to GFD-2 through an Amphenol #26-4100-16P connector.

Controls and Indicators: None

Construction: Made of finest materials. All metal parts protected against corrosion.

Color: Light gold chassis. Front panel nameplate is semi-gloss black with white lettering.

ORDERING INFORMATION

Specify: a. DCS Model GFD-2/LCA Low-Pass Filter (for Constant Amplitude) or DCS Model GFD-2/LLP Low-Pass Filter (for Linear Phase).
b. Intelligence frequency cut-off.

DATA-CONTROL SYSTEMS, Incorporated
San Francisco • Los Angeles • Danbury, Conn.
Albuquerque • Orlando

SUBJECT: SPARE PARTS KITS – DISCRIMINATORS
MODEL: GFD-2

KIT A

This kit consists of one complete set of tubes, silicon power diode rectifiers, and chopper for one GFD-2 Discriminator (including power supply). Kit A contains 50 pieces. (Drawing List BT-005895)

KIT B

This kit contains spare parts for the complete maintenance and repair of GFD-2 Discriminators (including power supplies but not tuning units or lowpass filters). * Kit B is recommended for maintenance and repair of an installation of approximately 10 GFD-2 Discriminators, and is intended to be adequate for 18 months of rigorous service. A detailed list of the approximately 1500 parts contained in Kit B is available on request. With reference to the number of parts in one discriminator, the kit contents are approximately as follows:

2 of each resistors, capacitors (other than electrolytic) tube sockets, connectors, mating connectors, preassembled attenuator switch and removable covers.

4 of each power transformer, diodes and transistors, meters, fuse holders, and printed circuit boards.

10 of each push-button switches, potentiometers.

20 of each electrolytic capacitors.

100 fuses

200 pilot lamps

approximately 200 miscellaneous hardware

*NOTE – It is recommended that tuning units and lowpass filters not be repaired in the field, but be returned to the factory where the required precise instrumentation is available to restore specification performance.

Spare tuning units and lowpass filters should be ordered with GFD-2 Discriminators primarily to increase the versatility of their use on different channels, but also to eliminate down time should repairs be needed.